

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE <div style="text-align: center;">J</div>		PAGE OF PAGES <div style="text-align: center;">1 2</div>	
2. AMENDMENT/MODIFICATION NO. 0003		3. EFFECTIVE DATE 23-Aug-2002		4. REQUISITION/PURCHASE REQ. NO. W68MD9-2016-0845		5. PROJECT NO.(If applicable)	
6. ISSUED BY USA ENGINEER DISTRICT, SEATTLE ATTN: CENWS-CT P.O. BOX 3755 SEATTLE WA 98124-3755		CODE DACA67		7. ADMINISTERED BY (If other than item 6) <div style="text-align: center; font-weight: bold;">See Item 6</div>			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				X		9A. AMENDMENT OF SOLICITATION NO. DACA67-02-R-0215	
				X		9B. DATED (SEE ITEM 11) 17-Jan-2002	
						10A. MOD. OF CONTRACT/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS							
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) Solicitation No: DACA67-02-R-0215 Project Title: Upgrade Wastewater Treatment Plant Correct administrative errors and correct engineering conflicts.							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: _____ EMAIL: _____			
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)		16C. DATE SIGNED 23-Aug-2002	

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

The following items are applicable to this modification:CONT. SHEET

A. This amendment is issued to provide for the revisions to the solicitation as follows:

- ? Revisions to the Special Clauses (00800), Table of Contents, and Sections 01025 Payment, 02531 Repair Sanitary Sewers, 05400 Cold-Formed Metal Framing, 08710 Door Hardware, 09910 Polyurethane and Polyvinyl Chloride Sheet Lining System, 11310 Pumps; Sewage and Sludge, 11336 Gravity Thickener Mechanism, 11337 Secondary Clarifier, 11380 Digester Gas Handling and Heating System, 11601 Laboratory Equipment and Fumehoods, and 13211 Pressure Vessels for Storage of Propane Gas.
- ? Deletion of Section 11315 Recessed Impeller Centrifugal Pumps

**B. THE PROPOSAL DUE DATE AND TIME HAVE BEEN CHANGED TO 3:00 PM,
4 SEPTEMBER 2002.**

C. NOTICE TO OFFERORS: Offerors must acknowledge receipt of this amendment by number and date on Standard Form 1442 BACK, in Block 19, or by telegram.

D. All Technical Amendments are available for download this date on the Army Corps of Engineers website at <http://www.nws.usace.army.mil/ct/>.

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SECTION 00800

SPECIAL CLAUSES

SC-1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) (FAR 52.211-10).

The Contractor shall be required to (a) commence work under this Contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 540 calendar days after date of receipt by Contractor of notice to proceed. The time stated for completion shall include final cleanup of the premises.

SC-1.1 OPTION FOR INCREASED QUANTITY

a. The Government may increase the quantity of work awarded by exercising Optional Item 0005 or 0006 at any time, or not at all, but no later than 90 calendar days after receipt by Contractor of notice to proceed. Notice to proceed on work Item added by exercise of the option will be given upon execution of consent of surety.

b. The parties hereto further agree that any option herein shall be considered to have been exercised at the time the Government deposits written notification to the Contractor in the mails.

c. The time allowed for completion of any optional items awarded under this contract will be the same as that for the base item, and will be measured from the date of receipt of the notice to proceed for the base item.

SC-1.2 Exception to Completion Period(s): In case the Contracting Officer determines that completion of seeding, sodding, and planting, and establishment of same is not feasible within the completion period stated above, the Contractor shall accomplish such work in the first planting period following the contract completion period and shall complete such work as specified, unless other planting periods are directed or approved by the Contracting Officer.

SC-2. LIQUIDATED DAMAGES - CONSTRUCTION (SEP 2000) (FAR 52.211-12)

- (a) If the Contractor fails to complete the work within the time specified in the Contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \$846.00 for each day of delay.
- (b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.
- (c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

- (d) Exception to Liquidated Damage: In case the Contracting Officer determines that completion of work stated above in paragraph Exception to Completion Period(s) is not feasible during the completion period(s) stated in SC-1, such work will be exempted from liquidated damages.

SC-3. TIME EXTENSIONS (SEP 2000) (FAR 52.211-13): Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the Contract completion date will be extended only for those specific elements related to the changed work and that the remaining Contract completion dates for all other portions of the work will not be altered. The change order also may provide for an equitable readjustment of liquidated damages under the new completion schedule.

SC-4. DELETED

SC-5. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JAN 1997) (FAR 52.228-5)

- (a) The Contractor shall, at its own expense, provide and maintain during the entire performance period of this Contract at least the kinds and minimum amounts of insurance required in the Insurance Liability Schedule or elsewhere in the Contract.
- (b) Before commencing work under this Contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective:
 - (1) for such period as the laws of the State in which this Contract is to be performed prescribe; or
 - (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.
- (c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this Contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the Contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.
- (d) Insurance Liability Schedule (FAR 28.307-2)
 - (1) Workers' compensation and employer's liability. Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when Contract operations are so commingled with a Contractor's commercial operation that it would not be practical to require

this coverage. Employer's liability coverage of at least \$100,000 shall be required, except in states with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(2) General Liability.

(a) The Contracting Officer shall require bodily injury liability insurance coverage written on the comprehensive form of policy of at least \$500,000 per occurrence.

(b) Property damage liability insurance shall be required only in special circumstances as determined by the agency.

(3) Automobile liability. The Contracting Officer shall require automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury and property damage liability covering the operation of all automobiles used in connection with performing the Contract. Policies covering automobiles operated in the United States shall provide coverage of at least \$200,000 per person and \$500,000 per occurrence for bodily injury and \$20,000 per occurrence for property damage. The amount of liability coverage on other policies shall be commensurate with any legal requirements of the locality and sufficient to meet normal and customary claims.

(4) Aircraft public and passenger liability. When aircraft are used in connection with performing the Contract, the Contracting Officer shall require aircraft public and passenger liability insurance. Coverage shall be at least \$200,000 per person and \$500,000 per occurrence for bodily injury, other than passenger liability, and \$200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least \$200,000 multiplied by the number of seats or passengers, whichever is greater.

SC-6. DELETED

SC-7. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) (FAR 52.236-1): The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty percent (15%) of the total amount of work to be performed under the Contract. The percentage may be reduced by a supplemental agreement to this Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SC-8. PHYSICAL DATA (APR 1984) (FAR 52.236-4): Data and information furnished or referred to below is for the Contractor's information. The Government will not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) Physical Conditions: Not used.

(b) Weather Conditions: Each bidder shall be satisfied before submitting his bid as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any National Weather Service Office.

- (c) Transportation Facilities: Each bidder, before submitting his bid, shall make an investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the jobsite. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of the work.
- (d) Right-of-Way: Not used.
- (e) Condition of Area: The condition of the area when last surveyed is shown on the drawings. Topography is in feet and represents elevation with reference to mean lower low water (M.L.L.W.).
- (f) Obstruction of Channel: Not used.
- (g) Datum and Bench Marks: The plane of reference shown on the drawings.

SC-9. DELETED

SC-10. LAYOUT OF WORK (APR 1984) (FAR 52.236-17): The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due, or to become due, to the Contractor.

SC-11 THROUGH SC-13. DELETED

SC-14. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAY 1999)-
(EFARS 52.231-5000)

- (a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.
- (b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense

Schedule, Region VIII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

- (c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.
- (d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.
- (e) Copies of EP1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" Volumes 1 through 12 are available in Portable Document Format (PDF) and can be viewed or downloaded at <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/cecw.htm>. A CD-ROM containing (Volumes 1-12) is available through either the Superintendent of Documents or Government bookstores. For additional information telephone 202-512-2250, or access on the Internet at http://www.access.gpo.gov/su_docs.

SC-15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAY 1999)-(EFARS 52.232-5000)

- (a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.
- (b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: Any other construction material stored offsite may be considered in determining the amount of a progress payment.

SC-16 AND SC-17. DELETED

SC-18. CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)(DOD FAR SUPP 252.236-7001)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors which might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general—

- (1) Large scale drawings shall govern small scale drawings; and
- (2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the index of drawings attached at the end of the Special Clauses.

SC-23. RECOVERED MATERIALS: The Corps of Engineers encourages all bidders to utilize recovered materials to the maximum extent practicable. The attached APPENDIX R contains procurement guidelines for products containing recovered materials.

APPENDIX R

PART 247 - COMPREHENSIVE PROCUREMENT GUIDELINE FOR PRODUCTS CONTAINING RECOVERED MATERIALS

40 CFR Ch. 1 (9-1-99 Edition)

Subpart B-Item Designations

§ 247.10 Paper and paper products.

Paper and paper products, excluding building and construction paper grades.

§ 247.11 Vehicular products.

- (a) Lubricating oils containing re-refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, excluding marine and aviation oils.
- (b) Tires, excluding airplane tire
- (e) Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

247.12 Construction products.

- (a) Building insulation product including the following items:
 - (1) Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock vermiculite, and perlite;
 - (2) Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool).
 - (3) Board (sheathing, roof decking wall panel) insulation, including but not limited to structural fiberboard and laminated paperboard products perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and
 - (4) Spray-in-place insulation, including but not limited to foam-in-place polyurethane and polyisocyanurate and spray-on cellulose.
- (b) Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing shingle backer, sound deadening board, roof insulating board, insulating wallboard, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels, floor underlayments, and roof overlay (cover board).
- (c) Cement and concrete, including concrete products such as pipe and block, containing coal fly as ground granulated blast furnace (GGBF) slag.
- (d) Carpet made of polyester fiber use in low- and medium-wear applications.
- (e) Floor tiles and patio block containing recovered rubber or plastic.
- (f) Shower and restroom dividers/partitions containing recovered plastic or steel.
 - (1) Consolidated latex paint used for covering graffiti; and (2) Reprocessed latex paint used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood and metal surfaces.

§247.13 Transportation products.

- (a) Traffic barricades and traffic cones used in controlling or restricting vehicular traffic.
- (b) Parking stops made from concrete or containing recovered plastic or rubber.
- (c) Channelizers containing recovered plastic or rubber.
- (d) Delineators containing recovered plastic, rubber, or steel.
- (e) Flexible delineators containing recovered plastic.

§ 247.14 Park and recreation products

- (a) Playground surfaces and running tracks containing recovered rubber or plastic.
- (b) Plastic fencing containing recovered plastic for use in controlling snow or sand drifting and as a warning/safety barrier in construction or other applications.

247.15 Landscaping products.

- (a) Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and as an over-spray for straw mulch in landscaping, erosion control, and soil reclamation.
- (b) Compost made from yard trimmings, leaves, and/or grass clippings for use in landscaping, seeding of grass or other plants on roadsides and embankments, as a nutritious mulch under trees and shrubs, and in erosion control and soil reclamation.
- (c) Garden and soaker hoses containing recovered plastic or rubber.
- (d) Lawn and garden edging containing recovered plastic or rubber.

§ 247.16 Non-paper office product.

- (a) Office recycling containers and office waste receptacles.
- (b) Plastic desktop accessories.
- (c) Toner cartridges.
- (d) Binders.
- (e) Plastic trash bags.
- (f) Printer ribbons.
- (g) Plastic envelopes.

§ 247.17 Miscellaneous products.

Pallets containing recovered wood, plastic, or paperboard.

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Fort Lewis, Washington
Project Number IJO DEP 17-1J, RPL Digesters;
IJO DEP 18-1J, RR Lift Station
File No. 22s/831-13-01

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91	M8-7	Existing Digester Gas Compressor Building No. 2 Plan and Section		25-Jan-02
92	M9-1	Digester Control Room No. 1 Demolition Plan and Sections		25-Jan-02
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148	E9-9	Existing/Demolition and Revised Electrical Plans - Existing Shop Building		25-Jan-02
149	E12-1	Power and Lighting Plan Temporary Administrative Facilities		25-Jan-02
149a	C-1	Repair Sanitary Sewers, Plan & Profile (Option Item 0003)		5-Jul-02

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149b	C-2	Repair Sanitary Sewers, Plan & Profile (Option Item 0003)		5-Jul-02
149c	C-3	Repair Sanitary Sewers, Plan & Profile (Option Item 0003)		5-Jul-02
149d	C-4	Sanitary Sewer Detail (Option Item 0003)		5-Jul-02

DRAWING REVISIONS BY NOTATION

Sheet 1, Plate G-1, Area Map: Change Option Item 0002 to 0005. Change Option Item 0003 to 0006.

Sheet 2, Plate G-2, Drawing Index - Civil Drawings: Sheets 149a, 149b, 149c, 149b, Change Option Item #0003 to #0006.

Sheet 11, Plate G-11: Delete callout located in the center and at the bottom of the sheet which reads, "Backflow Preventer and Hotbox See M2-2".

Sheet 29, Plate S-6:

a. Section J/S-4 - Change height callout on left side of the section from "VARIES ("H" MAX. =18'-6") to "VARIES ("H" MAX. = 19'-1 ½)".

b. Section H/S-4 – Change height callout on left side of section from "VARIES ("H" MAX.=10'-0") to "VARIES ("H" MAX.=11'-1 ½)".

Sheet 42, Plate S8-2, CMU WALLS PLAN: Add "3'-0"x7'-0" HM Door" callout to the door opening.

Sheet 45, Plate S8-5: Change Section reference from "J/S8-2" to "J/M8-2".

Sheet 46, Plate S9-1, Foundation Plan: Change the footing callout at the southeast corner of the Foundation Plan from "FTG 16"X18" DP" TO "FTG 16"x8" DP".

Sheet 54, Plate P9-2: Revise drawing – The two ½"W lines that are shown connecting to the 1"PRO line shall be changed to be shown connecting to the ¾"W that runs along the south side of the Administration Building.

Sheet 58, Plate H9-1, Chlor. Rm: Change note which reads, "Two existing wall mounted ... holes with CMU" to "Two existing wall mounted exhaust fans to remain."

Sheet 71, Plate M2-1: Add the following to Note 2. "At the Contractor's discretion, only the existing chains and flights may be removed and reinstalled to facilitate liner application. No equipment that is permanently affixed to the clarifier floors or walls may be removed. Any damaged equipment will be replaced by the Contractor at no additional cost to the owner."

Sheet 84, Plate M7-3, Sections A/M7-2 and B/M7-2: Change Detail callout "11/M-4" to "1/M-4" (2 places)

Sheet 90, Plate M8-6, Section B/-: Delete callout "SECOND STAGE PRESSURE REGULATOR (10 PSI TO 1 PSI)".

Sheet 149a, Drawing Title: Change Option Item #0003 to #0006.

Sheet 149b, Drawing Title: Change Option Item #0003 to #0006.

Sheet 149c, Drawing Title: Change Option Item #0003 to #0006.

Sheet 149d, Drawing Title: Change Option Item #0003 to #0006.

STANDARD DETAILS BOUND IN THE SPECIFICATIONS

Drawing Number	Sheet Number	Title	Date
<u>SECTION 01501 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS</u>			
	1	Hard Hat Sign	10SEP90
	1&2	U.S. Army Project Sign	84JUN20
<u>SECTION 02570 – VALVE VAULTS, CATCH BASINS AND MANHOLES</u>			
	7	WSDOT Catch Basin Type 1, Standard Plan B-1	1997
<u>SECTION 02770 – CONCRETE SIDEWALKS AND CURBS</u>			
	13	WSDOT Cement Concrete Curbs and Gutters, Standard Plan F-1	1997

END OF SECTION

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SECTION 01025

PAYMENT

PART 1 GENERAL

The contract price shall constitute full compensation for furnishing all plant, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the item in accordance with these specifications and the applicable drawings, including surveying performed by the Contractor. Payments shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. No separate payment will be made for the work, services, or operations required by the Contractor, as specified in DIVISION 1, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

1.1 PAYMENT

1.1.1 ITEM 0001 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0001, Upgrade Wastewater Treatment Plant, except for Items 0002, 0003, 0004, 0005 and 0006, payment of which shall constitute full compensation for Item No. 0001, complete.

1.1.2. ITEM 0002 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0002, All Work for As-Built Drawings; payment of which shall constitute full compensation of Item No. 0002 complete. No partial or total payment will be made for this item until the as-built drawings, both marked up blue prints and electronic files are fully approved by the Government (A or B action) and all copies of approved drawings and electronic media received by the Government.

1.1.3 ITEM 0003 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0003, All Work for O&M Manuals; payment of which shall constitute full compensation of Item No. 0003 complete. No partial or total payment will be made for this item until all O&M manuals are fully approved by the Government (A or B action) and all copies of final manuals are received by the Government in their final binders.

1.1.4 ITEM 0004 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0004, All Work for Form 1354 Checklist and Equipment in Place List; payment of which shall constitute full compensation of Item No. 0004 complete. No partial or total payment will be made for this item until both the 1354 Checklist and Equipment in Place List are fully approved by the Government (A or B action) and all copies of approved lists received by the Government.

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1.1.5 ITEM 0005 (OPTION ITEM)

Payment will be at the contract lump sum price for Item No. ~~00050002~~, Sludge Drying Bed Modifications, payment of which shall constitute full compensation for Item No. ~~00050002~~, complete.

1.1.6 ITEM 0006 (OPTION ITEM)

Payment will be at the contract lump sum price for Item No. ~~00060003~~, Repair Sanitary Sewers, payment of which shall constitute full compensation for Item No. ~~00060003~~, complete.

1.2 PROGRESS PAYMENT INVOICE

Requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

- 1.2.1 When submitting payment requests, the Contractor shall complete Blocks 1 through 12 of the "PROGRESS PAYMENT INVOICE" Form as directed by the Contracting Officer. (A sample form is attached at the end of this Technical Specification Section.) The completed form shall then become the cover document to which all other support data shall be attached.
- 1.2.2 One additional copy of the entire request for payment, to include the "PROGRESS PAYMENT INVOICE" cover document, shall be forwarded to a separate address as designated by the Contracting Officer.
- 1.2.3 The Contractor shall submit with each pay request, a list of subcontractors that have worked during that pay period. The listing shall be broken down into weeks, identifying each subcontractor that has worked during a particular week, and indicate the total number of employees that have worked on site for each subcontractor for each week. The prime Contractor shall also indicate the total number of employees for its on site staff for each week.

PART 2 (NOT USED)

PART 3 (NOT USED)

PROGRESS PAYMENT INVOICE

See Federal Acquisition Regulations (FAR) 32.900, 52.232-5, & 52.232-27

1. PROJECT AND LOCATION		2. DATE	
3. CONTRACTOR NAME AND ADDRESS (Must be the same as in the Contract)		4. CONTRACT NO.	
		5. INVOICE NO.	
6. DESCRIPTION OF WORK		7. PERIOD OF PERFORMANCE From: To:	
8. DISCOUNT TERMS			
9. OFFICIAL TO WHOM PAYMENT IS TO BE FORWARDED Name: Title: Phone: () -		10. OFFICIAL TO BE NOTIFIED OF DEFECTIVE INVOICE Name: Title: Phone () -	
11. CERTIFICATION: I hereby certify, to the best of my knowledge and belief, that (1) The amounts requested are only for the performance in accordance with the specifications, terms, and conditions of this contract; (2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; and (3) This request for progress payment does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.			
(Signature)		(Title)	
		(Date)	
12. OTHER INFORMATION OR DOCUMENTATION required by Contract. Provide two (2) copies of each (check and attach if applicable): <input type="checkbox"/> Updated Progress Chart/Schedule <input type="checkbox"/> Progress Narrative <input type="checkbox"/> Certified Payrolls (submitted weekly) <input type="checkbox"/> Safety Exposure Report <input type="checkbox"/> Updated Submittal Register <input type="checkbox"/> Progress Photos <input type="checkbox"/> Subcontractor/Employee Listings		(FOR GOVERNMENT USE ONLY) Retainage: ____% Amt.: \$_____ Withholdings: \$_____ Reason: _____ Following items are current: As-Builts ____ Yes ____ No O & M Manuals ____ Yes ____ No 1354 Data ____ Yes ____ No Submittal Register ____ Yes ____ No	

END OF SECTION

SECTION 02531

REPAIR SANITARY SEWERS
(OPTION ITEM #~~0003~~0006)

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 33	(1999) Concrete Aggregates
ASTM C 76	(2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 94	(2000) Ready-Mixed Concrete
ASTM C 150	(1999) Portland Cement
ASTM C 270	(2000) Mortar for Unit Masonry
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 828	(1998, R 1996) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM D 412	(1998) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension
ASTM D 624	(2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ASTM D 638	Test Methods for Tensile Properties of Plastics
ASTM D 790	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 1248	Specification for Polyethylene Plastic Molding and Extrusion Materials
ASTM D 1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2751	(1996) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	Specifications for Polyethylene Plastic Injection and Extrusion Materials
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	(2000) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F 1216	Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTALS:

SD-9 Statements

Method of Repair (FIO)

Provide a statement indicating the method of repair (replacement or cured in place pipe) selected for the existing sanitary sewer to be repaired. Method of pipe connection to existing and new manholes and structures.

Dewatering Plan (FIO)

Method of dewatering including equipment sizes and contingency plan should dewatering cause settlement of adjacent facilities. The plan shall show specific locations, in plan and section, where dewatering is expected, as well as general discussion of methods should water be encountered in other locations.

Bypass Pumping Plan (FIO)

Method and plan for the bypass pumping of existing sewer flows. The plan shall indicate how the Contractor will insure there are no overflows of untreated sewage.

Satisfactory Installation (FIO)

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and Specifications and the manufacturers prescribed procedures and techniques upon completion of the project and before final acceptance.

SD-13 Certificates

Portland Cement; FIO.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Installation (FIO)

A statement signed by the manufacturer's field representative certifying the Contractor's personnel are capable of installing the pipe on the project.

2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.
2.1.1 Concrete Pipe

Concrete pipe greater than 24 inches in diameter shall be reinforced and conform to ASTM C 76, Class IV. Pipe 36 inches or greater in diameter shall be bell and spigot type, tongue and groove type, or modified tongue and groove type.

2.1.2 PVC Pipe

24 inch and greater PVC shall be class C905 or PVC closed profile gravity sewer pipe. Class C905 PVC shall meet the requirements of UBPPA UNI-B-11. All PR165 pipe shall meet the requirements of DR25. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills. PVC profile sewer pipe shall meet the requirements of ASTM 794, cell class 12364A, with a minimum stiffness of 46 psi, meeting ASTM D2412.

2.1.3 Cured-in-Place Pipe Lining

Cured in place pipe lining shall be designed, manufactured and installed in accordance with ASTM F 1216. The cured in place pipe lining shall be designed to meet the following external loading conditions:

Depth of cover:	Maximum cover for each run between
Traffic Loading:	H-20 plus impact
Excavation widths:	Pipe OD plus 3'
Soil weight:	130 pcf
E' value:	700

For design purposes, the Contractor shall assume the groundwater table is one foot from the existing ground surface. The Contractor shall provide sealers and repairs to withstand this pressure.

The material when cured shall be continuous and formed to the original pipe, reconstructing the pipe's strength without allowance for the existing concrete pipe.

The tube shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the existing pipe.

Physical strength after curing shall conform to the following standards:

Cured Strength	Standard	Minimum
Tensile Stress	ASTM D638	3,000 PSI
Flexural Strength	ASTM D790	4,500 PSI
Flexural Modulus of Elasticity	ASTM D790	300,000 PSI

The contractor shall provide certification from the manufacturer that the pipe liner material conforms with the requirements of this Specification and specific installation requirements, including all steps of the heating and cooling phase listing pressure requirements, and length of time for each step in the processing.

2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Fittings for Concrete Pipe

ASTM C 76 for pipe greater than 24 inches in diameter.

2.2.2 Fittings for Plastic Pipe

PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.2.2.1 Fittings for PVC Pipe

ASTM D 3034 for type PSM pipe.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions.

2.3.1 Concrete Pipe Jointing

Joints and gaskets shall conform to ASTM C 443.

2.3.2 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.4 FLEXIBLE COUPLINGS

Flexible Couplings used for connection of pipe shall be as follows:

PVC to CONCRETE:	Romac Style RC 400 or TC 400, or equal. Flexible coupling shall be fusion bonded epoxy coated w/stainless steel bolts and nuts.
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2.5 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for PVC composite pipe shall conform to Figure 2 of ASTM D 2680 and Table 4 of ASTM D 3034.

2.6 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to

ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.7 MANHOLE STEPS/LADDER

2.7.1 POLYPROPYLENE MANHOLE STEPS

Polypropylene manhole steps shall be made of a copolymer polypropylene superior in its resistance, and meeting the requirements of ASTM 2146 Type II, Grade 16909, and shall completely encapsulate a deformed 1.2 inch steel reinforcing rod conforming to ASTM A615, Grade 60. Polypropylene steps shall be factory installed in complete accordance with the manufacturer's instructions.

2.7.2 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123.

2.8 MANHOLE MARKER POSTS

A manhole marker post shall be located adjacent to all manholes located outside the roadway corridor, or as directed by Fort Lewis Public Works. The marker post shall be green in color, 3.75 inches wide (flat), 60 inches long and furnished with a 3-inch by 3-inch high intensity white reflector (250 candle power) and a flexible anchor barb. The marker posts shall be set so as to leave 36 inches of the post exposed above grade.

2.9 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.9.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.9.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.10 STRUCTURES

2.10.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that Portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

3 EXECUTION

3.1 GENERAL

The Contractor shall assume the ground water is one foot below the ground surface. The Contractor shall provide sealers and repairs to withstand this pressure.

3.2 DEWATERING

During excavation, installation of conduit and structures, and the placing of backfill, excavations shall be kept free of water. The Contractor shall furnish all equipment necessary to dewater the excavation and shall dispose of the water in such a manner as not to cause a nuisance or menace to the public. The dewatering system shall be installed and operated by the contractor so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soil, prevent disturbance of backfill and prevent movement of structures and pipelines.

Dewatering shall be done by such method as the Contractor may elect. Dewatering sufficient to maintain the groundwater level at or below the surface of trench bottom, base of the bedding course or other foundation shall be accomplished prior to pipe laying and jointing or placement of reinforcing steel for concrete. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavation. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked or provided with other means to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to insure that the subsurface soil is not being removed by the dewatering operation. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop.

Should settlement be observed, the Contractor shall cease dewatering operations and implement contingency plans as outlined in the approved dewatering plan. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor. Permanent piping systems existing or new shall not be incorporated into the Contractor's dewatering system.

Depending on the groundwater inflow and the depth of excavation below the groundwater table, dewatering may require the installation of sumps, wells or well points. In general, if the

proposed excavation is to be more than 2 or 3 feet below the water table, sumps may not suffice, and dewatering may have to be accomplished using wells.

3.3 EXISTING SEWER FLOWS

The contractor shall provide for the diversion of sewer flows during construction. The Contractor shall take all steps necessary to ensure that the existing facilities or temporary facilities remain fully operational during all stages of construction. Overflows of untreated sewage will not be permitted. The Contractor shall be responsible for making all arrangements and scheduling for temporary sewage handling. This shall include all connections of temporary pumping equipment with temporary electrical service with controls.

The bypass pumping shall be designed to handle the existing sewer flows.

3.4 INSTALLATION

3.4.1 Adjacent Facilities

3.4.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

3.4.1.2 Structural Foundations

Where sewer pipe is to be installed within 3 feet of an existing or proposed building or structural foundation or any similar structure, the sewer pipe shall be sleeved as specified above. Contractor shall ensure there is no damage to these structures, and no settlement or movement of foundations or footing.

3.4.2 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended

by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

- d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint to prevent water or air passage at the joint between the inner and outer wall of the pipe.
- e. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be in accordance with ASTM F 402. The Contractor shall ensure adequate trench ventilation and protection for workers installing the pipe.

3.4.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 1 inch after caulking.

3.4.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.4.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.4.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.4.2.5 Jointing

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.4.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials

and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

3.4.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 0.2 gal per inch diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

Final air testing shall not be accepted until after the finished paving is accomplished, all other underground utilities have been installed and the lines have been flushed, cleaned, deflection tested and television inspected.

3.4.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 psi or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be spaced so that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being

flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.5 CURED IN PLACE PIPE (CIPP) INSTALLATION

3.5.1 CLEANING EXISTING PIPELINE

The Contractor shall clear and clean the line for the portion of work to be completed under the contract by flushing the line with water at pressure and volumes required to remove the existing materials prior to initiating work. The existing concrete pipe and manholes shall be pressure cleaned to remove all loose materials so as not to prohibit CIPP lining operations.

The Contractor shall insert a screen in the downstream manhole to catch the material for removal. The water can flow downstream in the existing sewer system.

All solids removed shall be disposed of in an environmentally safe manner and in accordance with State Department of Health Regulations. The Contractor shall submit to the Contracting Officer an outline of its methods, equipment and supplies proposed for cleaning the pipe.

3.5.2 PRECONSTRUCTION TELEVISION INSPECTION

All pipelines shall be inspected using closed circuit television equipment (CCTV). Television inspections will be performed after all other test requirements have been achieved. The Contracting Officer or Contracting Officer's representative shall be present during the television inspection. Inspections will be conducted at times agreed upon by the Contracting Officer and the Contractor and will be scheduled to coordinate with the project progress schedule.

If television inspections reveal areas where the construction is unsatisfactory, the Contractor shall, at his/her own expense, repair or replace all defective materials or workmanship. No repair shall be made until the repair method has been submitted to and approved by the Engineer. The results of the television inspections on those portions of the project so inspected shall be satisfactory to the Contracting Officer before the final acceptance of the project.

If the Contracting Officer requests a television inspection and the inspection reveals construction deficiencies which must be corrected, the cost of reinspection by television will be at no cost to the Government.

Television inspection for pipelines 8-inches and larger, shall be performed with a color CCTV tilt head camera recorded in standard VHS format. Television inspection for pipelines smaller than 8-inches shall be performed with a color push head CCTV camera recorded in standard VHS format.

3.5.3 CURED IN PLACE PIPE LINING FOR 24 AND 36-INCH PIPE

The contractor shall line the existing sanitary sewer pipe by furnishing and installing a tailored-thermostat impregnated flexible felt material, which is introduced into an existing pipeline by use of a hydrostatic head. The materials are cured by circulating hot water within the tube. When cured, the finished pipe shall be continuous and formed to the original pipe, reconstructing the pipe's strength without allowance for the existing deteriorated pipe.

3.5.4 EXISTING SERVICES

If the cured-in-place pipe is to traverse any existing service connections, the conduit entrance shall be opened out to the required dimensions. Service connections are to be reinstated internally with the use of a remote-controlled cutting device or man-entry techniques.

3.5.5 CURED IN PLACE PIPE CONNECTION TO EXISTING MANHOLES

If the cured in place replacement pipe is to traverse any existing manhole, the conduit entrance and exits to the existing manhole shall be opened out to the required dimensions and modifications shall be made to the invert before installation to maintain a smooth transition through the manhole.

3.6 POST-INSTALLATION CLEANING AND INSPECTION

Prior to final inspection, all pipelines shall be tested, flushed and cleaned, and all debris removed. A pipeline "cleaning ball" of the proper diameter for each size of pipe shall be flushed through all pipelines prior to final inspection.

Before sewer lines are accepted, the Contractor shall conduct a closed circuit television inspection, utilizing video equipment with pan and tilt capabilities, of the sewer pipe and appurtenances in the presence of the Contracting Officer, and provide two copies of the VHS videotapes to the Contracting Officer.

3.7 MANHOLE DETAILS

3.7.1 General Requirements

Manholes shall be constructed of concrete, or precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of

the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.7.2 Anchorage

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.7.4 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.7.5 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 2 inch adjusting rings. The bottom section shall be 12 inches in height. A 6 inch high top section will cover up to two, 2 inch adjusting rings. A 12 inch high bottom section will cover up to six, 2 inch adjusting rings. Extension sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 2 inches and shall be overlapped by the top section by 2 inches.

3.8 CONNECTING TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the

pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.9 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

3.10 TESTING OF MANHOLES

3.10.1 Vacuum Test

3.10.1.1 The Contractor shall be fully familiar with the vacuum testing equipment that he proposes to use. The vacuum test shall be performed prior to backfilling the manhole. All lift holes shall be plugged and pipe openings plugged and braced to prevent plugs from being drawn into the manhole.

3.10.1.2 Testing of all manholes shall be in accordance the following:

- a. Initial pressure test - 10 inches Hg (i.e. 20 inches Hg absolute)
- b. Test time - A vacuum of 10 inches of Hg shall be drawn and the vacuum pump shut off. With the valve closed, the time shall be measured for the vacuum to drop to 9 inches. The manholes shall pass if the time is greater than that shown below.

<u>Depth</u>	<u>Time (seconds)</u>					
	<u>48"</u> <u>Dia.</u>	<u>54"</u> <u>Dia.</u>	<u>60"</u> <u>Dia.</u>	<u>72"</u> <u>Dia.</u>	<u>120"</u> <u>Dia.</u>	<u>144"</u> <u>Dia.</u>
0-10	60	70	80	90	110	120
10-15	90	100	110	120	140	150
15-25	120	130	140	150	170	180

3.10.1.3 If pressure drop exceeds 1" Hg in 2 minutes, the unit shall be repaired and retested.

3.10.1.4 If a unit fails to meet a 1" Hg drop in 1 minute after repair, the unit shall be water exfiltration tested and repaired as necessary.

3.10.1.5 Joint repairs by parging are to be done on both outside and inside of joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair.

3.10.2 Repairs to manholes required to meet leakage requirements shall be accomplished using knife IGAS mastic, or joint sealant (chemical grouting) applied from outside the manhole or by other methods proposed by the Contractor and approved by the Contracting Officer.

3.11 ABANDON EXISTING MANHOLES

Where it is required that an existing structure be abandoned, the structure shall be broken down to a depth of at least 4 feet below the surface elevation, all connections plugged, and the manhole filled with sand and compact to 95% density. Debris resulting from breaking the upper part of the manhole may be mixed with the sand subject to approval of the Contracting Officer.

END OF SECTION

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SECTION 05400

COLD-FORMED STEEL FRAMING

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec	(1996) Specification & Commentary for the Design of Cold-Formed Steel Structural Members (Part V of the Cold-Formed Steel Design Manual)
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1997ae1) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
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ASTM A 153	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
------------	--

ASTM A 370	(1997a) Mechanical Testing of Steel Products
------------	--

ASTM A 653	(1999) Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
------------	--

ASTM B 633	(1985; R 1998) Electrodeposited Coatings of Zinc on Iron and Steel
------------	--

ASTM C 955	(1998) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
------------	--

ASTM E 329	(1998) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
------------	--

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel
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SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 78	(1998) Steel Self Drilling Tapping Screws
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Framing Components; G

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

Certificates

Mill Certificates.

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

Welds.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled preventing bending or other damage, and avoiding contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust.

2 PRODUCTS

2.1 STEEL STUDS, TRACKS, BRACING, BRIDGING, AND ACCESSORIES

Framing components shall comply with ASTM C 955 and the following:

- a. Material shall be corrosion-resistant steel complying with ASTM A 653, Grade 33 or higher, having a minimum yield of 33,000 psi and a G 60 minimum zinc coating.

- b. Minimum uncoated steel thickness (design thickness times 0.95):
 - (1) Studs and Tracks: 0.0677 inch.
 - (2) Bracing and bridging: Thickness as shown on the drawings.
 - (3) Accessories: Standard thickness as provided by the manufacturer.
- c. Stud and Track web depth: Depth as shown on the drawings.
- d. Stud flange width: 2 inches.

2.2 MARKINGS

Studs and track shall have product markings on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. Manufacturer's identification.
- b. Minimum delivered uncoated steel thickness.
- c. Protective coating designator.
- d. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J 78 of the type, size, and location as shown on the drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123 or ASTM A 153 as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123 or ASTM A 153 as appropriate.

3 EXECUTION

3.1 DELIVERY, HANDLING AND STORAGE

- a. Materials shall be delivered and handled in a manner to avoid bending or other damage and to avoid contact with the soil or other contaminating materials.
- b. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust.

3.2 CONNECTIONS

3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI Cold-Formed Spec. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint.

3.2.2 Screws

Screws shall be self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI Cold-Formed Spec. Screws covered by sheathing materials shall have low profile heads.

3.2.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.3 INSTALLATION

3.3.1 General Requirements

- a. Prefabricated frames shall be square, with components attached to prevent racking during fabrication, transportation, and lifting. Design and construction of frames shall include provisions for lifting.
- b. Cutting of steel framing shall be by saw, shear, or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.
- c. Temporary bracing shall be provided and remain in place until work is permanently stabilized.
- d. Abutting lengths of track shall be butt-welded, spliced, or each length securely anchored to a common structural element. Track shall be securely anchored to the supporting structure as shown on the drawings.
- e. Splicing of framing components, other than track and tension members, is not permitted.
- f. Wire tying of framing members is not permitted.

3.3.2 Non-Load Bearing Walls (Curtain walls)

- a. Studs shall be spaced as shown on the drawings.
- b. Studs shall be plumbed, aligned, and secured to the continuous runner tracks at each end, unless the stud end terminates at a deflection track.
- c. Tracks shall be securely anchored to the supporting structure as shown on the drawings.

- d. Bridging spaced as shown on the drawings shall be installed prior to the installation of facing materials.
- e. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall.
- f. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.
- g. Installation of sheathing, wallboards, or any other collateral material shall be performed in accordance with the product manufacturer's specifications.
- h. Components (Deflection Track and/or Slide Clips) shall be provided at locations shown on the drawings to accommodate potential movements of Primary Frames.

3.3.2.1 Lateral Load (Shear Wall Panels)

Shear wall panels shall be installed at the locations shown; stud spacing and arrangement shall be as shown; diagonal bracing shall be placed across studs, pulled tight, and attached to each stud within the shear panel as shown on the drawings.

3.3.3 Joists

- a. Joists shall be spaced as shown on the drawings.
- b. Uniform and level joist bearing at the foundation wall shall be provided by means of shims and/or shrink grout.
- c. Web stiffeners at support locations and at points of concentrated loads shall be provided as shown on the drawings.
- d. Bridging, of the type and spacing shown on the drawings, shall be installed prior to loading.
- e. Additional framing around openings shall be provided as shown on the drawings when the width of the opening exceeds the typical joist spacing.

3.4 TOLERANCES

Vertical alignment (plumbness) of studs shall be within 1/960th of the span. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths. Spacing of studs shall not be more than plus 1/8 inch from the designed spacing providing the cumulative error does not exceed the requirements of the finishing material.

3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

END OF SECTION

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SECTION 08710

DOOR HARDWARE

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F 883 (1990) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1 (1997) Butts and Hinges (BHMA 101)

ANSI/BHMA A156.2 (1996) Bored and Preambled Locks and Latches (BHMA 601)

ANSI/BHMA A156.3 (1994) Exit Devices (BHMA 701)

ANSI/BHMA A156.4 (1992) Door Controls - Closers (BHMA 301)

ANSI/BHMA A156.5 (1992) Auxiliary Locks & Associated Products (BHMA 501)

ANSI/BHMA A156.6 (1994) Architectural Door Trim (BHMA 1001)

ANSI/BHMA A156.7 (1988) Template Hinge Dimensions

ANSI/BHMA A156.8 (1994) Door Controls - Overhead Holders (BHMA 311)

ANSI/BHMA A156.13 (1994) Mortise Locks & Latches (BHMA 621)

ANSI/BHMA A156.15 (1995) Closer Holder Release Devices

ANSI/BHMA A156.16 (1997) Auxiliary Hardware

ANSI/BHMA A156.18 (1993) Materials and Finishes (BHMA 1301)

ANSI/BHMA A156.21 (1996) Thresholds

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 101 (1997) Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL BMD (1999) Building Materials Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, SUBMITTAL PROCEDURES.

Shop Drawings

Hardware schedule; G

Keying system

Product Data

Hardware items; G

Manufacturer's Instructions

Installation

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference Mfr.		Name and Catalog No.	UL Mark		ANSI/BHMA Finish Designa- tion
			Publi- cation Type No.	Finish		Key Con- trol Symbols	(If fire rated and listed)	

1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

- Complete listing of all keys (AA1, AA2, etc.).
- Complete listing of all key cuts (AA1-123456, AA2-123458).
- Tabulation showing which key fits which door.
- Copy of floor plan showing doors and door numbers.
- Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to ANSI/BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled HARDWARE SETS. Such hardware shall bear the label of Underwriters Laboratories, Inc., and be listed in UL BMD or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Hinges, pivots, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

ANSI/BHMA A156.1, 4 1/2 by 4 1/2 inches unless otherwise specified. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2 1/4 inches with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Knobs and roses of mortise locks shall have screwless shanks and no exposed screws.

2.3.3 Exit Devices

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Touch bars may be provided in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2 1/4 inches.

2.3.4 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores shall have six pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

2.3.5 Keying System

Provide an extension of the existing keying system.

2.3.6 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.6.1 Knobs and Roses

In addition to meeting test requirements of ANSI/BHMA A156.2 and ANSI/BHMA A156.13, knobs, roses, and escutcheons shall be 0.050 inch thick if unreinforced. If reinforced, outer shell shall be 0.035 inch thick and combined thickness shall be 0.070 inch, except knob shanks shall be 0.060 inch thick.

2.3.6.2 Lever Handles

Provide lever handles in lieu of knobs. Lever handles for exit devices shall meet the test requirements of ANSI/BHMA A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Lever handles shall return to within 1/2 inch of the door face.

2.3.6.3 Texture

Provide knurled or abrasive coated knobs or lever handles where specified in paragraph entitled HARDWARE SETS.

2.3.7 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

2.3.8 Door Bolts

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.9 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers. Provide manufacturer's 10 year warranty.

2.3.9.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.10 Closer Holder-Release Devices

ANSI/BHMA A156.15.

2.3.11 Door Protection Plates

ANSI/BHMA A156.6.

2.3.11.1 Sizes of Kick Plates

Width for single doors shall be 2 inches less than door width; width for pairs of doors shall be one inch less than door width. Height of kick plates shall be 10 inches for flush doors. Height of armor plates shall be 48 inches for flush doors, except that armor plates on fire doors shall be 16 inches high.

2.3.12 Door Stops and Silencers

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.13 Padlocks

ASTM F 883.

2.3.14 Thresholds

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.15 Weather Stripping

A set shall include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Weather stripping shall be one of the following:

2.3.15.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall be clear anodized.

2.3.15.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.3.15.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.3.16 Lightproofing and Soundproofing

A set shall include adjustable doorstops at head and jambs and an automatic door bottom, both of extruded aluminum, clear (natural) anodized, surface applied, with vinyl fin seals between plunger and housing. Doorstops shall have solid neoprene tube, silicone rubber, or closed-cell sponge gasket. Door bottoms shall have adjustable operating rod and silicone rubber or closed-cell sponge neoprene gasket. Doorstops shall be mitered at corners. Zero "Sound Stop 1" (No. 770 and No. 361); Pemko No. 350ASN and No. 430AS; National Guard No. 1038N and No. 420; or equal.

2.3.17 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant conforming to Section 07900, JOINT SEALING, and fasten with stainless steel screws.

2.3.17.1 Door Rain Drips

Approximately 1 1/2 inches high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.17.2 Overhead Rain Drips

Approximately 1 1/2 inches high by 2 1/2 inches projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.3.18 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Hardware shall have BHMA 612 finish (satin bronze), unless specified otherwise. Surface door closers shall have bronze paint finish. Steel hinges shall have BHMA 639 finish (satin bronze plated). Exposed parts of concealed closers shall have finish to match lock and door trim. Hardware showing on interior of bathrooms, shower rooms, toilet rooms, washrooms, laundry rooms, and kitchens shall have BHMA 629 finish (bright stainless steel) or BHMA 625 finish bright chromium plated.

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inches o.c. after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door one inch o.c. and to heads and jambs at 4 inches o.c.

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1 1/2 inches o.c.

3.1.2 Lightproofing and Soundproofing Installation

Install as specified for stop-applied weather stripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

ANSI/SDI 100, unless indicated or specified otherwise.

- a. Kick: Push side of single-acting doors. Both sides of double-acting doors.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where indicated. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

HW-1 (Doors 1, 2, 3, 4, and 5 each leaf)

1 1/2 Pair Hinges
1 Lockset
1 Kick Plate
1 Wall Bumper

HW-2 (Door 6 each leaf)

1 1/2 Pair Hinges
1 Lockset
1 Kick Plate
1 Wall Bumper
1 Threshold
1 Set Weatherstripping

HW-3 (Door 9 each pair)

3 Pair Hinges
2 Exit Devices
1 Removable Mullion
2 Closers
2 Kick Plates
2 Wall Bumpers
1 Threshold
1 Set Weatherstripping

HW-4 (Door 10 each leaf)

1 Privacy Lock

HW-5 (Door 9 each pair)

1 Bi-fold Door Hardware

HW-~~26~~ (Door s 67 and 8 each leaf)

1 1/2 Pair Hinges
1 Privacy Lockset
1 Closer
1 Kick Plate
1 Wall Bumper

END OF SECTION

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SECTION 09910

POLYURETHANE AND POLYVINYL CHLORIDE SHEET LINING SYSTEM

1 GENERAL

1.1 REFERENCES

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-SP 1	Solvent Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-PA-3	"A Guide to Safety in Paint Application"
SSPC-VIS-1	"Pictorial Surface Preparation Standards"

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)

NACE Publication 6D-173	"A Manual for Painter Safety"
NACE Publication TPC2	Coatings and Linings for Immersion Service: Chapter 1 Safety, Chapter Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection
NACE Publication 6F-163	"Surface Preparation of Steel or Concrete Tank Interiors"
NACE RP0892-92	Standard Recommended Practice, Lining over Concrete in Immersion Service
NACE RP0288-88	Standard Recommended Practice, Inspection of Linings on Steel and Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B499	Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals.
ASTM C794	L.R. Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants, (modified for field conditions).
ASTM D4138	L.R. Standard Test Methods for Measurement Dry Film Thickness of Protective Coating Systems by Destructive Means.
ASTM D2369	Standard Test Method for Volatile Content of Coatings.
ASTM D4787	L.R. Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.

ASTM D5162	L.R. Standard Practice for Discontinuity Testing of Nonconductive Protective Coating on Metallic Substrates.
ASTM D4262	L.R. Standard Test Method for pH of Chemically Cleaned or Acid Etched Concrete Surfaces.
ASTM D4414	L.R. Standard Practice for Measurement - Wet Film Thickness by V Notch Gages.
ASTM D4417	Field Measurement of Surface Profile of Blast Cleaned Steel, Test Methods.
ASTM E337	L.R. Standard Practice Test Method for Measuring Humidity with a Psychrometer.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Product Data

Method and Materials; G

Information shall include proposed blasting material and methods, methods for repairing joint leaks, product material safety data sheets, storage requirements, mixing and proportioning requirement and environmental requirements for application and worker safety; including ventilation, temperature range and humidity.

Certificates

Contractor's Certification; G

Manufacturer's documentation that the contractor, or the subcontractor proposed for the lining installation, is certified for the manufacturers coating system. Manufacturers certification of each applicator proposed for the lining installation.

1.3 SUMMARY

This Section specifies the installation of a continuously adhered polyurethane and polyvinyl chloride (PVC) sheet lining system to be applied to the interior concrete surfaces of the four (4) existing primary clarifiers as shown on the Plans and specified herein. System shall consist of an impermeable sheet liner anchored with a chemical resistant polyurethane rubber mastic system that bonds both mechanically and molecularly to the concrete substrate. The mastic system shall have been proven resistant to acid corrosion and the prevention of the migration of corrosion and corrosive ingredients should the liner be damaged. All seams and terminations shall be of a type that are of proven design for resistance to failure and shall inhibit the circumvention of the protective system by surface attack and by migration behind the liner through surface capillary action. Surfaces exposed to direct sunlight shall be UV protected. Wear strips shall protect areas

subject to mechanical abrasion by the clarifier flights. These strips must be compatible with the co-lining system and suitable for the purpose for which they are employed. Contractor to provide all materials, labor and equipment necessary to complete the lining work specified herein.

1.4 TRAINING AND CERTIFICATION

The Contractor shall only provide personnel who have been trained by the manufacturer to perform lining system installation. The Contractor shall arrange for and provide payment to the manufacturer for such training as part of its lining system work.

One full day of training (one, 8-hour sessions) shall be required for all Contractor personnel performing lining system work. All Contractor personnel receiving training shall be paid for their training time by the Contractor.

After successful completion of training, each of the Contractor's personnel will receive a certificate evidencing completion of the training and authorizing them to install the prescribed system. Only those personnel who have been appropriately trained and so certified in writing by the manufacturer may be used by the Contractor to perform the lining system work.

The Contracting Officer or Manufacturer's representative may require removal of any Contractor personnel due to poor workmanship, non-compliance with installation requirements as specified herein, or failure to follow direction provided by the Contracting Officer, at the Contracting Officer's sole discretion and determination. The Contractor shall, at no additional cost to the OWNER, promptly replace such individuals with other personnel who have been trained as described above.

Lining application done under this specification shall be inspected by an AUTHORIZED INSPECTOR of the lining manufacturer and shall be subject to inspection by the Contracting Officer. All parts of the work shall be accessible to the Technical Inspector and the Contracting Officer. Defective work shall be corrected as directed by the Technical Inspector of the manufacturer and the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING:

The Contractor shall provide all materials necessary for execution of the lining system work. The Contractor shall order materials and arrange delivery by the Manufacturer in a manner that ensures that materials are on hand and do not unnecessarily inhibit accomplishment of work in a timely manner.

The Contractor shall store all materials only in area or areas designated by the Contracting Officer solely for this purpose. Confine mixing, clean-up and associated operations, and storage of debris before disposal, to these areas. All materials shall be stored on pallets or similar storage/handling skids off the ground and storage shall comply with the manufacturers recommendations.

The Contractor shall mix all lining materials in an enclosed mixing area provided by the Contractor, at a location designated by the Contracting Officer. This enclosed area shall protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination. The Contractor shall protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area.

Drain piping shall not be used for disposal of lining materials.

The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with the lining system as described on the pertinent Material Safety Data Sheets or container labels.

Receipt, storage, and handling of materials shall be the responsibility of the Contractor.

1. Labels on all material containers must show the following information:
 - a. Name or title of product.
 - b. Manufacturer's batch number.
 - c. Manufacturer's name.
 - d. Application and mixing instructions.
 - e. Hazardous material identification label.
 - f. Shelf life.
2. All containers shall be clearly marked indicating any personnel safety hazards associated with the use of or exposure to the materials.
3. All materials shall be handled and stored to prevent damage or loss of label.
4. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.

2 PRODUCTS

2.1 APPROVED MANUFACTURER'S

The polyurethane and polyvinyl chloride sheet lining system shall be as manufactured by Linabond, Inc., or equal.

2.2 MATERIALS – GENERAL

The lining system for this project must be of an approved system that employs an impermeable PVC sheet liner that is covalently bonded to a chemical resistant polyurethane rubber base that resists corrosion should the liner be violated by damage. The mastic is continuously and covalently bonded to the substrate. This mastic system must restrict the migration of corrosive materials behind the liner should it be breached. Repairs must be easily made that return the liner system to like new or better performance. The seams and terminations of the system must be easily adapted to various angles, curves, and transitions to various materials. Components of the system shall facilitate the installation over various corners, both inside and outside, through the use of extruded PVC devices designed to ensure that these areas are fully protected and that the sheet liner may transition over them without adverse affect upon its adherence to and protection of the substrate.

Components of the system shall consist of an epoxy polyurethane primer specially formulated depending upon the moisture content of the substrate, a high-solids chemical resistant polyurethane rubber base material, a high-solids polyurethane seam material that is non-expanding, equal to or greater than the PVC in wastewater chemical resistant tests, will not swell or absorb water during continuous immersion and exhibit chemical resistance characteristics in wastewater equal to or greater than the sheet liner, the

anchoring mastic and the concrete substrate to ensure it will not fail. The system shall employ a special activator for the surface of the PVC sheet that enables it to bond with the various mastic systems and an extruded PVC sheet.

All materials necessary to complete the lining system work as specified herein shall be purchased by the Contractor and installed by the Contractor.

2.3 LINING SYSTEM MATERIALS

The lining system consists primarily of an epoxy polyurethane primer (depending upon moisture content of the substrate), a high solids polyurethane mastic joint sealant, a high solids polyurethane seam material (Hi-mod mastic), a surface activator for a polyvinyl chloride (PVC) sheet, an extruded PVC sheet, and pre molded PVC corners.

2.3.1 Primer

Primer shall be of a variety that is suitable for application under ambient temperatures suitable for the workspace. It shall be for use in priming concrete substrates in accordance with the substrate moisture and pH ranges specified by the manufacturer. It shall be a high solids, two component primer with a relatively fast (45 minutes) initial cure time. Surfaces to be primed shall not be below 50 degrees Fahrenheit. The Primer shall have at least the following properties.

Mix Ratio	1:1
Elongation	@ 35 Percent
Tensile Strength	> 2,000 psi
Weight/Gallon	@ 9.6 Pounds
Viscosity	@ 250 Centipoise
Pot Life (quart)	@ 30 minutes
Concrete Surface pH Range*	7.0 to 12.0
Substrate Moisture Tolerance*	< 30 % Maximum

**pH and substrate moisture as measured in accordance with Section 3.6 herein.*

For extremely porous concrete more than one coat of primer may be required.

Note: When groundwater conditions exceed 5 psi or as indicated on the Contract Drawings, the primer shall be followed by the high modulus non-expanding mastic rather than directly with an elastomeric material. Additionally, a structural polymer coating that exhibits significant strength and resistance to elongation of more than 2-5%, fully compatible with the PVC liner, shall be used where hydrostatic pressure may present a significant problem.

2.3.2 Polyurethane Mastic

The polyurethane mastic is a high solids low modulus chemical resistant polyurethane rubber mastic/joint sealant. The mastic is permanently flexible, non-flow when mixed and is resistant to weathering, aging, dilute acids (7% sulfuric acid solution, or acid conditions generating pH levels of 0.5) and dilute alkalis. The material covalently bonded to the activated polyvinyl chloride liner and to the primed concrete surface and has a work life of up to 2 hours. With special formulation by the manufacturer the material must have the

capability of being either trowel or spray applied using special, spray equipment approved by the manufacturer. The polyurethane mastic shall exhibit at least the following properties:

Performance Properties	Non-flow (typical)
Hardness, Shore A	>30
Non-volatile Content	> 93 Percent
Adhesion, ASTM C-920	> 30 pli
Tensile, ASTM D-412	> 175 psi
Elongation, ASTM D-412	> 300 Percent
Maximum Usable Temperature	200°F (service temp)
Minimum Usable Temperature	- 40°F (service temp)
Tack-free Time @ 75° to 80°F	16 Hours

2.3.3 PVC Sheet Surface Activator

The surface activator shall be used for activating all PVC Sheets to be installed. The surface activator is a rapid drying, impregnating vinyl resin providing cross-linking of the polyurethane mastic with the polyvinyl chloride sheet. The surface activator shall exhibit the following properties:

Color (Gardner)	Violet
Weight/Gallon	@ 8 Pounds
Surface Dry	10 – 25 Minutes

2.3.4 Seam Material

The seam material shall be a high modulus polyurethane non-expanding mastic exhibiting low permeability and high acid resistance and strength. It shall be a plural component high strength, acid resistant hybrid urethane. The seam material is the same material used for high-modulus mastic. The seam materials shall be used at all seams and terminations. The seam material has the following properties:

Solids (by weight)	>97%
Side A Specific Gravity	0.96
Side B Specific Gravity	1.1
Flash Point	550° F
Mix Ratio	1 to 1
Initial Cure Time	1 to 3 hours
Tensile, ASTM D638	> 1600 psi
Elongation, ASTM D638	35 %

2.3.5 Polyvinyl Chloride (PVC) Liner

The PVC lining material is a homogenous thermoplastic PVC sheet material of 30 mil uniform thickness with the following properties manufactured for compatibility with the sheet activator.

a. Chemical Resistance

<u>Chemical Solution</u>	<u>Concentration</u>
Sulfuric acid	20 percent*
Sodium hydroxide	5 percent
Nitric acid	5 percent*
Ferric chloride	1 percent*
Sodium Hypochlorite	1 percent
Soap	0.1 percent
Detergent (Linear alkyl benzyl sulfonate or LAS)	0.1 percent
Bacteriological	BOD not less than 700 ppm

*Volumetric percentages of concentrated C.P. grade reagents.

b. Physical Properties

<u>Property</u>	<u>Initial Value*</u>
Tensile Strength	2,300 psi
Elongation at break	300 % min

*When tested at $77 \pm 5^\circ F$.

The PVC lining is white in color.

2.3.6 Wear Protection Strips

The Contractor shall install a PVC lining strip (Wear Protection Strip) at the wall soffits, flight returns below the discharge weirs, and sidewalls where wear indicates a need for protection in each structure as required to protect against excessive wear as shown on the drawings. The PVC lining strip shall be 30 mils in thickness and 11-inches wide or as specified in the drawings. It shall be attached to the protective lining system with the acid resistant polyurethane Seam Material and by cross-linking with the activator the mastic with the PVC lining. The strip and the liner shall be approximately 60 mils but shall not interfere with the operation of the flights. The cross-linking attachment shall be accomplished by activating each PVC material with the surface activator as specified in 3.5 of this Section.

2.3.7 PVC Lining UV Blocker

The Contractor shall install an UV Blocker on all surfaces of the Protective Lining System that will be exposed to sunlight. The liquid UV Blocker shall be applied by brush or roller to the PVC lining prior to replacing or installing the aluminum covers, grating or other equipment. The UV Blocker shall be Linabond No. 55 Aliphatic Topcoat, or equivalent, and shall be applied at the rate of 300 square feet per gallon.

3 EXECUTION

3.1 SAFETY

Contractor shall comply with all current local, state, federal, and other applicable safety and health regulations.

At the completion of the job, all hazardous materials and waste are to be removed in accordance with local, state, and federal regulations.

3.2 THINNERS AND SOLVENTS

Only cleaning solvents approved by the manufacturer shall be used in this contract.

3.3 CONTROL OF AMBIENT CONDITIONS IN STRUCTURES TO BE LINED

The Contractor shall control ambient conditions in the structures to be lined, and provide protective enclosures during surface preparation, application, and curing, to meet the ambient conditions specified below. The Contractor shall continue to meet the ambient conditions throughout the lining system work.

The ambient condition requirements inside the clarifier channels and structures during all phases of lining system work shall be as follows:

1. Air temperature - no lower than 65°F
2. Relative humidity - no higher than 90%
3. Substrate surface temperature - no lower than 50°F, and at least 10°F higher than dew point temperature
4. No dust generation shall be allowed during this period

Contractor shall provide ventilation, heating, isolation and any other measures necessary to perform the lining system work in each channel and structure to be lined.

3.4 REQUIREMENTS FOR CLEANING AND SURFACE PREPARATION

The Contractor shall provide initial cleaning, substrate decontamination, and degreasing for the structures that have been exposed to wastewater, as specified herein.

All channels and structures to be lined, including previously exposed concrete and new concrete structures, shall receive surface preparation provided by the Contractor as specified herein.

3.4.1 Initial Cleaning, Substrate Decontamination, and Degreasing for Concrete Structures Previously Exposed to Wastewater:

The Contractor shall provide initial cleaning consisting of high pressure water washing using a minimum cleaning pressure of 5,000 psi, a minimum cleaning volume of 6 gallons per minute, and using clean, potable water, only. This initial cleaning shall remove all wastewater solids/residues, scum, all debris such as embedded dirt, loose coatings, and all other substances from the structures to be lined.

The Contractor shall provide degreasing of concrete substrates by using hot water with detergents, followed by rinsing with clean, potable water, until all traces of degreasing/cleaning solutions have been removed.

The Contractor shall remove all debris, wastewater constituents, and spent cleaning water from the structures to be lined by pumping and/or by vacuum cleaning. The waste and spent water used for this initial cleaning shall be conveyed to a location identified by the Contracting Officer.

3.4.2 General Surface Preparation Requirements

Blast abrasive shall be sufficiently hard and sharp to quickly and easily remove surface corrosion and carbonation without unduly removing excess materials. Only new and unused blast abrasives shall be brought to the site. Those products used on site that have been contaminated or rendered ineffective shall not be reused on this Project. It is preferred that blast media be equal to or greater than 16 mesh. River sand is not authorized for use.

The compressed air used for blast cleaning shall be filtered and shall contain no condensed water and no oil. Moisture traps shall be cleaned at least once every four hours or more frequently as required to prevent moisture from entering the supply air to the abrasive blasting equipment.

Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. These shall be checked on the same frequency as the moisture traps as defined in above paragraph.

Regulators, gauges, filters, and separators shall be in use on all of the compressor airlines to blasting nozzles at all times during this work.

An air dryer or desiccant filter drying unit shall be installed which dries the compressed air prior to blast pot connections. This dryer shall be used and maintained for the duration of all surface preparation work.

The abrasive blast nozzles used shall be of the at least a 3/8 inch diameter venturi or other high velocity type supplied with a minimum of 500 cfm air at @100 psi and sufficient volume to obtain the blast cleaning production rates and cleanliness specified herein.

The Contractor shall provide ventilation for airborne particulate evacuation (meeting all pertinent safety standards) to optimize visibility for both blast cleaning and inspection for the substrate during surface preparation work.

Ground fault interrupters shall be used on all electrical equipment used to perform the work.

If between final surface preparation work and lining application, contamination of the prepared and cleaned substrates occurs, or if the prepared substrates' appearance darkens or changes color, recleaning by waterblasting, reblasting and abrasive blast cleaning shall be provided by the Contractor at no additional cost to the OWNER until the specified degree of cleanliness is reclaimed.

The Contractor shall be responsible for dust control and for protection of mechanical, electrical, and all other equipment within the treatment facilities during abrasive blasting activities as specified and as indicated.

3.4.3 Surface Preparation of all Concrete Substrates

The Contractor shall abrasive blast clean all concrete surfaces to produce a sound, clean substrate free of laitence, surface contaminants, and loose materials.

The Contractor shall abrasive blast clean all concrete surfaces (new concrete, previously coated concrete, and concrete previously exposed to wastewater) to produce a minimum, uniform substrate anchor pattern or profile similar to 60 to 80 grit sand paper.

Should abrasive blast cleaning not remove degraded concrete, chipping or other abrading tools shall be used to remove the deteriorated concrete until a sound, clean substrate is achieved which is free of calcium sulfate, loose coarse or fine aggregate, laitence, loose hydrated cement paste, and other substances detrimental to the lining system's adhesion or cure, as indicated by the Contracting Officer. Abrasive blast cleaning and other means necessary shall be used by the Contractor to open up all air voids or "bugholes" to expose their complete perimeter.

Acceptable surface preparation shall produce a concrete surface pH of 7.0 to 12.0 to be confirmed by surface pH testing as specified under paragraph 3.6, herein. Acceptable surface preparation shall remove all concrete acid reaction materials.

Acceptable surface preparation shall result in a concrete substrate moisture content of less than 30 percent as measured using a Delmhoist Moisture Meter, model "DP", as specified herein.

Following inspection of the concrete surface preparation by the Contractor and release by the Contracting Officer and the authorized manufacturer representative, thoroughly vacuum clean all concrete surfaces to be lined to remove all loose dust, dirt, and spent abrasive leaving a dust free, sound concrete substrate. All debris produced by blast cleaning shall be removed from the structures to be lined and disposed of by the Contractor at a location designated by the OWNER. The Contractor shall again inspect and if specified conditions are met, the CONTRACTING OFFICER and the manufacturer's representative will release the substrate to allow commencement of lining system installation.

3.4.4 Surface preparation of Bare and Coated Metal Substrates onto which Lining System will Terminate

Surfaces of all metal substrates at various embedments and penetrations shall be abrasive blast cleaned to remove all existing coatings, paints, dirt corrosion products, and other substances that would prevent the specified lining adhesion from being achieved. All metal surfaces shall be abrasive blast cleaned to a white metal blast in accordance with SSPC-5.

Post Blast Cleaning: Once abrasive blast cleaning has been completed by the Contractor and released by the Contracting Officer and the lining manufacturer's representative, the Contractor shall:

- a. Remove all traces of grit, dust, dirt, rust scale, friable material, loose corrosion products or embedded abrasives from substrate by vacuum cleaning prior to lining system application.
- b. Prevent contamination of the concrete or metal surfaces after blasting from workers' fingerprints, substances on workers' clothing, or from atmospheric conditions. If, after cleaning, contamination occurs, reblast and reclean to achieve specified substrate cleanliness.

c. Adjacent coatings not required to be removed shall be protected as specified and as indicated. Once the Contractor has completed surface preparation, the Contractor shall identify all voids in the concrete surface that are deeper than 1/2" and/or wider (in any direction) than 2". The Contractor shall repair these voids with a polymer modified cementitious repair mortar, or a material approved by the manufacturer for this use. All repaired surfaces shall be leveled with a long straight edge in order to

minimize surface variations over the majority of the wall. Once the repair mortar has cured for a minimum of 7 days, its surface shall be abrasive blast cleaned as specified above. Alternately, with approval of the Contracting Officer, additional elastomeric or high modular non-expanding mastic may be used to fill such voids and no sandblasting will be required. Establishment of a fairly smooth profile of 3/8" or less will significantly improve the physical appearance of the finished surface.

3.5 INSTALLATION OF LINING SYSTEM

The Contractor shall obtain the services of an authorized technical representative of the protective lining system's manufacturer. This Technical representative will provide continuous field inspection, instruction, and direction to the lining Contractor during installation of the protective lining system. He will insure that the work, including but not limited to, the surface preparation, mixing and curing times and application procedures, are performed in a manner that meets the manufacturer's minimum requirements for product warranty and manufacturer's recommendations and the clients specifications. Daily reports will be submitted along with adequate photographic records to assure the client and manufacturer that work is being performed in accordance with specifications and installation instructions. These records will be reviewed daily by the contractor, the clients authorized representative, and the manufacturer's technical representative and access provided to the client, Contracting Officer, and manufacturer for review through a discreet Internet connection, password protected with access controlled by the client.

The lining system shall provide a sealed membrane to prevent penetration of H₂S gas, other gases, and liquids to the substrate.

Termination of the lining system at leading edges (below the water line) and at all metallic and non-metallic interruptions to the concrete substrate, (pipe supports, pipe penetrations, gates to adjacent structures, tanks, ~~and~~ channels, clarifier equipment, etc.) shall be installed ~~as indicated in the details, included in the contract drawings~~ in accordance with the manufacturer's standard details. Where the liner may be subjected to forces or come in contact with moving equipment that will place pulling forces upon the liner, it shall be anchored in the substrate by being embedded in a saw cut approximately 1/2 inch deep by 1/4 inch wide and anchored in high modulus seam material. All saw cuts and anchoring of the liner at its perimeter and at seams shall be accomplished using high modulus polyurethane mastic

Primer shall be brush or roller applied to the prepared concrete surface previously exposed to wastewater, at a rate not to exceed 180 square feet per gallon of primer, and shall be brush or roller applied to prepared new concrete surfaces (previously uncoated, with no exposure to wastewater) at a rate not to exceed 200 sq. ft. per gallon. The primer shall be allowed to cure to become tack-free before the mastic is applied. However, application of the primer shall precede the mastic application by no more than a 7 day period. Note: For extremely porous concrete more than one coat of primer may be required.

On concrete previously exposed to wastewater, the chemical resistant polyurethane rubber mastic shall be applied by troweling with a notched trowel at an average minimum film thickness of 120 mils. On new concrete surfaces, the polyurethane mastic shall be applied by troweling at an average minimum film thickness of 60 mils. The application of mastic shall not exceed that area which can be lined with the PVC sheets within 2 hours (@ <72 degrees F) of mastic application or by the end of the work shift, whichever comes first. Higher temperatures will decrease PVC application window.

The PVC sheet surface activator shall be roller applied to the PVC liner material and allowed to become tack-free prior to application to the substrate. Activated PVC sheets shall be protected from debris

contamination prior to installation. The top surface of any sheet which will be lapped during installation shall be activated after the sheet is in place. The surface activator shall be applied using a roller.

The PVC sheet liner shall be applied within five minutes minimum and two hours maximum of mastic application (see above). Mastic surface and the activated PVC sheet surface shall be kept clean and free of dust and debris until the lining is set in the mastic. The Contractor shall utilize the maximum size liner sheet possible at any application to minimize the number of seams. The edges of the lining shall be thoroughly sealed with the high modulus mastic where they join or terminate onto metal or concrete surfaces.

All surfaces of the installed PVC liner shall be thoroughly rolled or smoothed with an appropriate blade or Vinyl flooring roller to remove air inclusions and to ensure good adhesion to the chemical resistant polyurethane rubber mastic. The rolling process shall occur immediately after the PVC sheet application onto the mastic.

The Contractor shall:

1. Roller apply the PVC sheet surface activator to the overlap zone 4 inches from the edge of any installed PVC sheet.
2. Activate the top face of a 4-inch wide band (on the opposite side) at the edge of each PVC sheet that will receive the seam material.
3. Lower sheets should have masking or removable packing tape approximately 1-inch beyond the 4-inch wide band. The top sheet should have tape approximately 1-inch from the edge. These strips of tape are to assist in preventing seam material in spreading beyond the required 1-inch band referred to in H7, below
4. Apply the seam material over this 4-inch wide activated area to a nominal thickness of 1/16-inch using a hand trowel. This material can be properly mixed and loaded into special dispensing guns with instructions from the manufacturer and then spread with a trowel.
5. Apply the next sheet ensuring a 4-inch overlap.
6. Roll and press the overlap to remove all entrapped air and to force a bead of the Seam Material to be squeezed out at the seam.
7. Tool the excess Seam Material, adding additional Seam Material if required, to completely seal a 1-inch wide overlap of the PVC sheets with seam material having a minimum thickness of 1/8" or 125 mils. All seams must be taped with masking tape or otherwise clearly defined to provide a neat appearance.

All penetrations of the polyvinyl chloride liner shall be sealed with the seam material as indicated. The seam material shall be trowel applied.

For concrete previously exposed to wastewater, the average film thickness of the cured lining system shall not be less than 150 mils.

All lining system terminations at or around pipe supports/pipe or conduit penetrations, at hatch openings, and at all other terminations of or interruptions to the lining system shall be installed as indicated. All such terminations shall be sealed using the high modulus seam material.

When the surface temperatures of the concrete substrates to be lined are rising due to exposure to direct sunlight, outgassing of air from the concrete will result in excessive gas pockets in the lining system. Application of the lining system in such locations shall be postponed until the concrete is no longer exposed to direct sunlight, and its temperature is stable or falling. The Contractor shall prevent such rising substrate temperatures by protecting concrete substrates from sunlight. (Note: This can be achieved by shifting work hours to evening.) Should gas pockets or discontinuities form in the applied lining system, they shall be repaired as specified herein.

Treatment of the lining system at expansion joints, cold joints, control joints, isolation joints' or cracks shall be installed as indicated.

The finished lining system shall be protected from damage during curing and shall be cured no less than three (3) days. The Contractor shall control ambient conditions during curing to ensure a temperature of 65°F or greater and a relative humidity of not more than 90%.

3.6 QUALITY CONTROL, INSPECTION, AND TESTING

Inspection by the Contracting Officer, the manufacturer's authorized technical representative, or others does not limit the Contractor's responsibility to install the lining system as specified herein.

3.6.1 Quality Control Procedures

The Contractor shall perform the quality control procedures listed below:

1. Inspect and record all lining system materials upon receipt to ensure that all are as approved by the client or his contract representative.
2. Provide specified storage conditions for the lining system, solvents and abrasives.
3. Verify and record that degree of substrate cleanliness using SSPC-VIS-1 for metallic substrates and visual inspection and pH testing for concrete substrates. Acceptable pH shall be between 7.0 and 12.0 as measured by a full range (7-12 min) color indicating pH paper with readable color calibrations and a scale of whole numbers (or smaller gradations). Use Hydrion Insta-Check Jumbo 0-13 or 1-12 or equal. When dry concrete substrate is encountered for a pH test, the surface where the pH test is to be performed shall be sprayed lightly with distilled, de-ionized water from a commercially available spray bottle that has been rinsed to preclude dissolved solids. The spray shall wet the surface and water shall not run down the wall. Wait 60 seconds to allow chemical equilibrium to be established and then test the pH of the water on the surface and record the value. If the concrete is dry, continue to spray lightly until a 60 second period will still provide a wet surface without water running down the wall for pH measurement. The paper shall be touched to the surface once using moderate finger pressure unless the surface is very soft. If the surface is soft, it requires additional cleaning before pH testing. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not wipe the surface. Compare the color indicated with the scale provided and record the pH. This visual inspection and pH testing shall be performed at least once for every 200 sq. ft. of surface are to be lined.

4. Verify and record substrate profile (anchor pattern) requirements using a K.T. Surface Profile Comparator for Metallic Substrates and visual inspection and comparison to a 60 to 80 grit sand paper sample for concrete substrates. Perform metal substrate profile measurements in accordance with ASTM D4417, once for every 300 sq. ft. of surface area to be lined. Perform profile comparison for concrete at this same frequency.
5. Measure and record ambient air temperature once every two hours during each shift (starting at the beginning of each shift) using a thermometer. Measure and record substrate temperature once every two hours during each shift (starting at the beginning of each shift) using a surface thermometer.
6. Measure and record relative humidity every two hours of each shift using a sling psychrometer in accordance with ASTM E337.
7. Measure and record substrate moisture content using a Delmhoist Moisture Meter Model "DP. " Press the two points into the prepared concrete substrate and press the test button. Read the substrate moisture content in percentage by viewing the percent level indicated by needle on the scale. Meter shall be calibrated to its most sensitive setting prior to each measurement. Perform this test once for every 100 sq. ft. of area to be lined and more frequently at darkened concrete areas. The acceptable moisture content for lining system application is no higher than 30 percent as measured using the Delmhoist meter.
8. Verify correct mixing of lining materials as specified herein.
9. Verify that the "pot life" of lining materials is not exceeded during installation.

3.6.2 Adhesion in Peel Testing

Test for inter-coat and overall lining system adhesion to the substrate in accordance with ASTM C794 modified for field conditions, as follows:

1. Using a metal ruler and marker, mark a strip 1-inch wide and 6-inches long. Make marks at 1/2-inch increments along the strip using the ruler.
2. Using a utility knife, cut through the PVC sheet making a loose end of the strip 3-inches long and 1-inch wide.
3. Use a pair of vice grips or similar clamping tool to grip the loose end of the PVC strip.
4. Attach the vice grips to a spring scale having a range of at least 50 lbs.
5. Pull the scale away from the wall to pull the strip away from the mastic.
6. Measure the force in pounds (lbs.) required to peel one linear inch of liner.
7. The tester should wear a safety shield while performing this test.
8. The minimum acceptable test value is 30 lbs/inch, except where the hot spray primer and Hi-mod mastic is used, where the minimum test value is 40 lbs/inch.

9. This test shall only be performed following a minimum of 7 days of lining system cure, and shall be performed once for every 500 sq. ft. of area to be lined. If acceptable test results are achieved in a structure or channel after four tests, this frequency of testing shall be modified to every 1000 sq. ft. of area to be lined. The 500 sq. ft. frequency shall be reestablished whenever the protective lining work is moved to a new structure or area.
10. At any location where specified adhesion results are not obtained, additional adhesion testing as specified herein shall be performed at a different location within 1'-0" of the unacceptable test location on the same PVC sheet. If the specified result is obtained at this new location, the locations where testing was performed shall be repaired as specified herein. If specified adhesion results are not obtained after testing two locations on one PVC sheet, the Contractor shall remove the PVC sheet and install a completely new lining system where the sheet was removed at no additional cost to the OWNER.
11. Verify continuity of lining system applied over metallic substrates in accordance with ASTM D5162. The lining must be 100% pinhole free. Pinhole testing (or continuity testing) shall be performed over 100 % of the metal surface area lined. The voltage setting shall utilize the rule of 100 volts per mil of lining thickness.
12. Measure and record & thickness of the lining system using the following methods:
 - a. Polyurethane Mastic (over concrete) - use notched gauge in accordance with ASTM D4414 for Wet Film Thickness.
 - b. Polyurethane Mastic over ferrous metallic substrates - use magnetic or eddy current type gauges in accordance with ASTM E376 for Cured Dry Film Thickness. Measure once every penetration or once every 100 sq. ft. to be lined, whichever is more frequent.
13. Upon lining system installation completion while scaffolding is still in place, the surface of the lining system shall be cleaned and prepared to permit visual inspection, continuity testing, and adhesion testing.
 - a. All surfaces of the liner shall be visually inspected by the Contractor for areas showing poor adhesion, air inclusion, edges or seam defects or any other defects in the lining preventing a complete seal of the surfaces to be protected.
 - b. Continuity testing and adhesion testing shall be performed as specified herein.
 - c. Access to the liner surface shall be provided by the Contractor, by leaving the installation scaffolding in place for the duration of the curing and inspection period. The areas where the destructive testing (adhesion test) was performed shall be repaired per Paragraph 3.8C of this Section.
14. Holiday and Pinhole Spark Testing
 - a. Location of holidays and pinholes in the lining system shall be performed in the field using spark testing. Upon completion of the lining system installation, the surface of the lining system shall be cleaned to permit visual inspection and holiday testing by the Contractor. All areas of the lining system failing to meet the field test shall be repaired and retested. The

spark testing shall be done with a Tinker & Rasor Holiday Detector (Model AP-W). This testing shall be performed in accordance with ASTM D4787. Follow ASTM D-4787 Section 12, for adjusting the voltage setting for the lining system. Generally, the setting should total 100 volts per mil of lining system thickness.

b. Marking of Holidays

Holidays are to be marked on the lining system using felt tipped pens or other markers approved by Manufacturer. Holidays are to be repaired in accordance with the requirements of Paragraph 3.8. Holiday detection is to be repeated only over the lining system repair locations.

3.7 FINAL INSPECTION

A final inspection shall be performed by the Contractor, the manufacturer's representative and the Contracting Officer.

Final inspection by the Contractor and Contracting Officer shall include the following:

1. Average Dry Film Thickness (DFT) shall meet the requirements specified herein.
2. Film thickness tolerance variations in lining system shall be as follows:

Minimum DFT: 30.0 mils (PVC thickness)

Maximum DFT: 500.0 mils (permission of Contracting Officer required for higher film thicknesses)
3. Lining system shall provide a sealed membrane to prevent penetration of H₂S gas, other gases, or liquids to the substrate, based on the following criteria:
 - a. No materials applied following depletion of pot life or when exceeding maximum recoat times.
 - b. No excessive runs, drips, sags or sloughs.
 - c. No pinholes or holidays.
 - d. Specified film thicknesses within tolerances.
 - e. No intercoat bond failures between system layers.
 - f. No entrapped air pockets behind PVC sheets greater than 4-inches in diameter.
 - g. Proper curing of lining as required herein.
 - h. Minimum PVC sheet lap lengths of 4" except on premolded comers where lap lengths of 3" are acceptable.
 - i. Sealing of all penetrations with high modulus mastic.
 - j. Proper application of pre-molded PVC corners as specified herein.
 - k. Lining finish must be uniform and smooth with no rough edges, pinholes, or areas lower than specified minimum lining thickness.

4. Rework required on any pinholes, holidays or any other rework required in the lining system shall be marked by the Contractor. Such areas shall be recleaned and repaired by the Contractor, as specified herein, at no additional cost to the OWNER.

3.8 REPAIR OF PROTECTIVE LINING SYSTEM DEFECTS

The Contractor shall repair all defects, pinholes, and holidays in the protective lining system, as follows:

1. Clean an area 6" beyond the perimeter of the defect lining system area using a clean, white rag dampened with acetone to remove all dirt and dust. Allow to dry for five minutes.
2. Activate the area over the defect using the PVC sheet surface activator.
3. Apply the high modulus polyurethane mastic (seam material) at 60 mils DFT over the activated area. Use a notched trowel.
4. Activate a patch that will extend a minimum of 4" beyond the perimeter of the defect and press this into the high modulus polyurethane mastic and roll to remove entrapped air. A 1-inch wide bead shall be formed to encapsulate the PVC edges around the entire perimeter of each patch. This same repair procedure is to be used for punctures to the lining system.

Repairs to entrapped air pockets in the PVC sheets greater than 4-inches in any direction shall be performed by the Contractor as follows:

1. Cut open the PVC sheet comprising the air pocket. Trim to remove damaged PVC sheet to ensure that the PVC will lay flat when this repair is complete.
2. Clean an area extending at least 4 inches in all directions from the cut line in the PVC sheet using a clean white rag dampened with acetone to remove dirt and dust. Allow to dry for 5 minutes.
3. Apply the PVC sheet surface activator over the cleaned area.
4. Using a notched trowel, apply the high modulus mastic at 60 mils DFT over the activated area and force under the loose edges of the PVC sheet pressing them into the mastic.
5. Activate a PVC sheet patch large enough to cover the cut line in the air pocket with a 4-inch lap beyond the air pocket in all directions. Roll to remove entrapped air. A 1-inch wide bead shall be formed to encapsulate the PVC edges around the entire perimeter of each patch.

Damaged locations in the lining system caused by Adhesion in Peel Testing shall be repaired by the Contractor as follows:

1. Cut the peeled back lining material to remove it.
2. Clean a squared-up area a minimum of 6 inches in all directions from the removed PVC material and mastic. Activate the area with PVC sheet activator.
3. Apply high modulus polyurethane mastic at 60 mils DFT over the activated area of the PVC sheet using a notched trowel. Completely fill the cut out area of mastic.

4. Activate a patch of PVC sheet that will extend a minimum of 4" beyond the perimeter of the damaged area and press this into the high modulus mastic and roll to remove entrapped air. A 1-inch wide bead shall be formed to encapsulate the PVC edges around the entire perimeter of each patch.

4. LINING SYSTEM INSTALLATION CHECKLIST

LINING SYSTEM INSTALLATION CHECKLIST

Structure to be lined: _____

Date: _____ Contract Package No. _____

Contractor: _____

Name of Contractor's Project Manager: _____

Name of Contracting Officer: _____

Name of MANUFACTURER'S AUTHORIZED INSPECTOR: _____

Lining Manufacturer: _____

Step 1: Completion of Initial Cleaning and Substrate Decontamination Prior to Abrasive Blast Cleaning.

Name: _____ Name: _____ Date ____/____/____
Manufacturer's Inspector Engineer

Step 2: Completion of Protective Enclosures of Structure and Equipment.

Name: _____ Name: _____ Date ____/____/____
Manufacturer's Inspector Engineer

Step 3: Installation of Ambient Condition Controls and Ventilation System to meet application and curing requirements for the lining system.

Name: _____ Date ____/____/____
Manufacturer's Inspector

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DEP 18-1J

Name: _____ Date ____/____/____
Contracting Officer

Step 4: Completion of Surface Preparation for Concrete and Metallic Substrates to Be Lined
(Including Required Minimum pH of 7.0 to 12.0) or Where Lining Terminates.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 5: Completion of Primer Application on All Substrates.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 6: Completion of Polyurethane Mastic Application.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 7: Completion of Surface Activator Application to PVC Sheets.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 8: Completion of PVC Sheet Installation and Lining Detail Treatment at all Penetrations and
Terminations.

Name: _____ Date ____/____/____
Manufacturer's Inspector

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Name: _____ Date ____/____/____
Contracting Officer

Step 9: Completion of Full Cure of Lining System.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 10: Completion of Adhesion-in-Peel Testing of Cured Lining on Concrete Substrates Only and Completion of Holiday (Continuity) Testing of Lining System on Concrete and Metallic Substrates.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 11: Inspection of Localized Repairs to Lining System Following C Continuity Testing.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____
Contracting Officer

Step 12: Completion of Lining System Work Including Final Clean-Up of the Work Site.

Name: _____ Date ____/____/____
Manufacturer's Inspector

Name: _____ Date ____/____/____

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Project No. DEP 17-1J
DEP 18-1J

CONTRACTING OFFICER

END OF SECTION

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SECTION 11310

PUMPS; SEWAGE AND SLUDGE

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

AFBMA Std 9 (1990) Load Ratings and Fatigue Life for Ball Bearings

AFBMA Std 11 (1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48 (2000) Gray Iron Casting

ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASME INTERNATIONAL (ASME)

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Equipment Installation; G

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

Product Data

Sewage and Sludge Pump System; G

Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent (100 percent for positive displacement pumps) of design capacity. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, spare parts, and installation instructions.

Test Reports

Field Testing and Adjusting Equipment; G

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

Operation and Maintenance Data

Sewage and Sludge Pump System; G

See Section 01701 for requirements.

1.3 SCOPE

The Contractor shall furnish, install, and place into satisfactory operating condition one (1) dry-pit centrifugal pump, seven (7) rotary lobe pumps, and two (2) recessed impeller centrifugal pumps, as shown on the Plans and specified herein.

1.4 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Dry Pit Centrifugal Pump:	
Sludge Transfer Pump	08 STP 01
Rotary Lobe Pumps:	
Digester Recirculation Pump No. 1	08 DRP 01
Digester Recirculation Pump No. 2	08 DRP 02
Digester Recirculation Pump No. 1	09 DRP 01
Digester Recirculation Pump No. 2	09 DRP 02
Thickened Sludge Pump No. 1	06 TSP 01
Thickened Sludge Pump No. 2	06 TSP 02
Scum Pump	06 SCP 01
Recessed Impeller Centrifugal Pumps:	
Grit Pump No. 1	01 GP 01
Grit Pump No. 2	01 GP 02

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation, dirt and dust, or other contaminants.

2 PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

Materials and equipment shall be as specified below and as shown on the Plans, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests.

2.2 DRY-PIT CENTRIFUGAL PUMPS

Centrifugal solids handling pumps shall be of the nonclogging centrifugal solids handling type designed to pump solids up to 3 inches in diameter and which provide no internal interstices that catch solids and stringy materials to cause clogging.

2.2.1 Pump Characteristics

Pump number 08 STP 01 located in Digester Control Room No. 2 shall have the following operating characteristics:

- a. Pump Service: digested sludge.
- b. Design Operating Point: 500 gpm flow, 36 feethead, 75 percent efficiency.
- c. Maximum Operating Point: 800 gpm flow, 23 feethead, 65 percent efficiency.
- d. Minimum Operating Point: 200 gpm flow, 45 feethead, 55 percent efficiency.
- e. Impeller Type: enclosed nonclog.
- f. Operating Speed: nominal 1,200 rpm.
- g. Maximum NPSH Required at Maximum Operating Point: 15.
- h. Motor Type: Vertical Close-Coupled.
- i. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- j. Size: Within rated load driving pump at specified rpm.
- k. Pump Control: As shown on drawings.

2.2.2 Pump Casing

Pump casing shall be constructed with tapped and plugged holes for venting and draining the pump. The casing shall be capable of withstanding pressures 50 percent greater than the maximum operating pressure. The volute shall have smooth passages. The casing shall be such that the impeller can be removed without disturbing the suction and discharge connections. The casing shall have a handhole

to permit inspection and cleaning of the pump interior. Lifting eyes shall be provided to facilitate handling of the pump.

2.2.3 Impeller

The impeller shall be designed with smooth passages to prevent clogging and pass stringy or fibrous materials. The impeller shall be statically, dynamically, and hydraulically balanced within the operating range and to the first critical speed at 150 percent of the maximum operating speed. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction.

2.2.4 Wearing Rings

Renewable wearing rings shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Wearing rings shall be constructed of cast iron. Wearing rings shall be designed for ease of maintenance and shall be secured to prevent rotation. Replaceable steel wear plates fastened to casing may be used in lieu of wearing rings on casing and impeller.

2.2.5 Pump Shaft

Pump shaft shall be of stainless or high grade alloy steel and shall be of adequate size and strength to transmit the full driver horsepower with a liberal safety factor.

2.2.6 Pump Shaft Sleeve

The pump shaft shall be protected from wear by a stainless steel, high grade alloy steel, or bronze shaft sleeve. The joint between the shaft and sleeve shall be sealed to prevent leakage.

2.2.7 Mechanical Seals

Double mechanical seals shall be provided to seal the pump shaft against leakage. Each seal interface shall be held in contact by its own spring system, supplemented by external liquid pressures. The seal system shall be constructed to be readily removable from the shaft.

2.2.8 Bearings

Pump bearings shall be ball or roller type designed to handle all thrust loads in either direction. Pumps depending only on hydraulic balance end thrust will not be acceptable. Bearings shall have an ABEMA L-10 life of 50,000 hours minimum, as specified in AFBMA Std 9 or AFBMA Std 11.

2.2.9 Lubrication

Bearings shall be grease lubricated. A grease fitting shall be provided for grease-lubricated bearings. The grease fitting shall be of the type that prevents overlubrication and the building up of pressure injurious to the bearings. If the grease fitting is not easily accessible, grease tubing shall be provided to a convenient location.

2.2.10 Spare Parts

One set of manufacturer's spare pump parts shall be provided for the pump in labeled, wood boxes, with moisture protection and contents labeled for the pump. The following spare parts shall be provided and stored in protective containers:

Gaskets.....	1 set
Wear Ring.....	1 each
Impeller Nut.....	1 each
Locking Set Screw.....	1 each
Impeller Key.....	1 each
Bearings.....	1 set
Snap Rings.....	2 set
Grease Seal.....	1 each
Grease Retainer.....	1 set
Shaft Sleeve.....	1 each
Mechanical Seal.....	1 each

2.2.11 Pump Support

Vertical dry pit centrifugal pumps shall be supported by a heavy steel or cast iron base with adequate legs to provide maximum rigidity and balance.

2.3 ROTARY LOBE PUMPS

Rotary lobe pumps shall be of the positive displacement type and shall consist of two tri-lobe rotors which draw product into pockets formed between the rotors and rotor case and push pumped material 180 degrees around the interior of the contoured rotor case and out through the discharge port.

The rotary lobe pumps shall all be supplied by either Vogelsang, Inc., Boerger LLC, or Swaby Manufacturing Co. ~~No other manufacturer shall be accepted.~~

2.3.1 Pump Characteristics

2.3.1.1 Digester Recirculation Pumps

Pumps located in Digester Control Room No. 1 (08 DRP 01 and 08 DRP 02) and No. 2 (09 DRP 01 and 09 DRP 02) shall each have the following characteristics:

- a. Pump Service: digested sludge.
- b. Design Capacity: 180 gpm.
- c. Operating Head: 58 feet.
- d. Impeller Type: tri-lobe.
- e. Operating Speed: nominal 315 rpm.
- f. Motor Type: piggyback mounted with v-belt.

- g. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- h. Size: Within rated load driving pump at specified rpm.
- i. Pump Control: As shown on the drawings.

2.3.1.2 Thickened Sludge Pumps

Pumps located in the thickened sludge pump building shall each have the following characteristics:

- a. Pump Service: thickened sludge.
- b. Design Capacity: 150 gpm.
- c. Operating Head: 72 feet.
- d. Impeller Type: tri-lobe.
- e. Operating Speed: nominal 150 rpm.
- f. Motor Type: piggyback mounted with v-belt.
- g. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- h. Size: Within rated load driving pump at specified rpm.
- i. Pump Control: As shown on drawings.

2.3.1.3 Scum Pump

- a. Pump Service: scum.
- b. Design Capacity: 14 gpm.
- c. Design Head: 72 feet.
- d. Impeller Type: tri-lobe.
- e. Operating Speed: nominal 150 rpm.
- f. Motor Type: piggyback mounted with v-belt.
- g. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- h. Size: Within rated load driving pump at specified rpm.
- i. Pump Control: As shown on drawings.

2.3.2 Casing

Rotor casing shall be constructed of cast iron. The gear casing shall be constructed of cast iron. A removable end cover shall allow access to tri-rotor elements without need to disturb packing glands, bearings, suction, or discharge connections.

2.3.3 Rotors

Pump rotors shall be tri-lobe form high quality tool steel encapsulated in urethane or Buna-N. A removable and replaceable wear plate shall be provided between the rotors and rotor case to protect the rotor case from wear. Rotors shall be located on shafts by positive locking assembly.

2.3.4 Shafts and Sleeves

Shafts shall be of high grade carbon steel fitted with replaceable stainless shaft sleeves where passing through gland area. Shafts shall be timed in their rotation by zero backlash timing gears keyed to shafts and running in a separate oil chamber gear case. Seals shall prevent ingress of pumped material into gear case.

2.3.5 Mechanical Seals

Split silicon carbide mechanical seals shall be provided for each positive displacement pump. A blocking chamber located behind the mechanical seal, and in front of the bearing housing lip seal shall be molded into the casting of the pump. This chamber shall be suitable for fill, from the side of the pump, through nipples, and have an external sight glass to review the status of the mechanical seals operation, mounted on the opposite side of the pump, located in easy view of the operator.

2.3.6 Mounting

The pump and motor shall be mounted on a steel base plate complete with necessary couplings, guards, and mounting hardware in the horizontal position with the motor mounted above the pump and connected to the pump with V-belts and sheaves package. Provide pump base and piggyback mounting arrangement. Pump base shall have adequate room for casing drain as shown on the drawings. Pump base shall be suitable for the installation as shown on the drawings.

2.3.7 Bearings

Pump shall have heavy duty antifriction roller or ball type bearings for shaft support, with a ABEMA L-10 life of 100,000 hours at maximum operating conditions. Oil seals shall prevent ingress of pumpage into gear case. A slinger for each shaft shall be provided.

2.3.8 Spare Parts

Manufacturer's spare pump parts shall be provided for the pumps in labeled, wood boxes, with moisture protection and contents labeled for the pump. The following spare parts shall be provided and stored in protective containers.

Rotary Lobes.....	1 set for each pump model
Lobe Puller Tool.....	1 kit for each pump model
Gasket & Keys	1 set for each pump

2.4 RECESSED IMPELLER CENTRIFUGAL PUMPS

The pumps shall be of a fully recessed, Slurry Type design, with the impeller mounted completely out of the flow path between the pump inlet and discharge connections, so that solids are not required to flow through the impeller. All flow path clearances within the pumps shall be equal to or greater than the discharge diameter, so that all solids, which will pass through the discharge, will pass through the pump. The pumps head capacity curve shall slope upward toward shutoff in one continuous curve with no points of inflection capable of causing hunting at any pump operational speed.

The grit pumps shall be Wemco Model C overhead mount, belt driven pumps with 3-inch suction and discharge connections and a 13.875-inch diameter impeller or Goulds Pump equivalent model, or equal.

2.4.1 Pump Characteristics

Grit pumps numbers 01 GP 01 and 01 GP 02 located in the grit pump room at the headworks shall have the following characteristics:

- a. Pump Service: grit slurry.
- b. Design Operating Point: 220 gpm @ 35 1/2 feet of head.
- c. Shutoff: 0 gpm, 36 feethead.
- d. Impeller Type: recessed.
- e. Operating Speed: 1,000 rpm maximum.
- f. Motor Type: Piggyback mounted with v-belt.
- g. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- h. Size: within rate load driving pump at specified rpm.
- i. Pump Control: as shown on drawings.

2.4.2 Pump Construction

The pumps shall be specifically designed to pump slurries of grit, debris and organic solids. Pumps shall be evaluated on the following elements.

- 1. Materials of construction of the wearing parts.
- 2. Thickness of component wearing parts.
- 3. Hydraulic design for wear minimization.
- 4. Mechanical design for overall ruggedness and simplicity of maintenance.

All cast parts exposed to wear shall be constructed of Ni-Hard material, conforming to ASTM A532, Class I and be a minimum of 650 BHN. Brinell values below this are not acceptable.

The following minimum thickness and weights of component wearing parts shall be furnished for cup-type impeller pumps:

- | | |
|--|------------|
| 1. Minimum casing thickness | 9/16-inch |
| 2. Minimum suction piece thickness at wear area | 1-inch |
| 3. Minimum impeller vane thickness at wear area | 7/8-inch |
| 4. Minimum impeller shroud thickness at wear area | 1-1/8-inch |
| 5. Minimum weight of wearing parts (suction piece, impeller, casing and wearplate) | 340 pounds |

The following minimum thicknesses of wearing parts shall be furnished for radial vane impeller pumps:

- | | |
|---|------------|
| 1. Minimum casing thickness | 1/2-inch |
| 2. Minimum impeller vane front edge thickness | 1/2-inch |
| 3. Minimum radial wear element base thickness | 1-1/8-inch |
| 4. Minimum radial wear element tip thickness | 3/4-inch |
| 5. Minimum suction wear piece thickness | 7/8-inch |

For pumps with radial vane impellers, the pump casing shall consist of one piece casting with integral suction and discharge nozzles plus a backplate with integral wear element. The casing will have cast-on feet, which will fully support the volute, to allow removal of the complete rotating assembly, without disturbing suction or discharge piping.

Machined registers or other joints between wear parts shall not be located in any area subjected directly to wear, such as the suction piece to casing fit, or the casing to wearplate or backplate fit.

For pumps with cup type impellers, the pump casing shall be of the two-piece, radially split-type, with a separate and removable suction piece designed so that the impeller can be withdrawn without the need to remove the discharge casing or disturb the discharge piping. The casing shall be constructed so that it can be reversed for opposite rotation, and shall be of Ni-Hard.

For pumps with cup type impellers, the hydraulic design of the impeller shall be such that fluid flow is directed to the suction piece, which shall be designed as a sacrificial part and be easily replaceable. The impeller shall be of Ni-Hard and of the cup type design, such that the vane ends are surrounded by an integral shroud.

Pumps with radial vane impellers shall be fully recessed out of the casing passage. Impeller shall be fitted with back pumpout vanes to restrict flow behind the impeller and shall be keyed to the shaft and secured by a shrouded security bolt and lock washer.

Pumps with radial vane impellers shall be fitted with a rear casing wear plate and integral radial wear element which will protect the area behind and at the periphery of the impeller from the brunt of the abrasive wear. The radial wear element shall be of tapered design to promote flow of solids out of the impeller recess.

For pumps with cup type impellers, a removable wearplate of Ni-Hard shall be provided in back of the impeller designed to direct flow from behind the impeller to the center of the volute for maximum protection to the casing. The packing housing shall be a separate piece bolted to the bearing housing for ease of removal.

Pumps shall be equipped with slotted raised-face flanges to receive 125-pound standard bolting. Special case slots shall be cast in to retain bolts and to fasten the case to the bearing housing and to the intake for easy case removal.

The shaft shall be of ASTM A108, Grade 1141 or 4140 steel, and shall be protected throughout the packing area by a removable, hardened stainless steel shaft sleeve conforming to ASTM A582 Type 416. The pumps shall be supplied with a backplate constructed of ASTM A48 Class 30 Grey Iron.

A single cartridge mechanical seal requiring no external flushing shall be furnished in the pump. The seal shall utilize a tungsten carbide rotational sealing ring mounted in an elastomer cup with an o-ring mounted silicon carbide stationary ring loaded by a non-fouling, conical spring encapsulated in Viton. Installation of the seal shall require no measurements or scribe marks on the shaft.

Bearings shall be oil bath lubricated. The oil reservoir shall be sealed at both ends to prevent entrance of foreign matter. The thrust bearings shall consist of three angular contact ball bearings for maximum protection from all thrust loads. The bearing housing will be equipped with a pressure venting device and oil fill, and drain taps. A built-in sight glass shall be furnished to check proper oil level. The bearings shall be rated for a minimum B10 life of 100,000 hours, based on calculated loads due to hydraulic thrust at the duty point as well as other mechanical loading due to belt drives or shaft and impeller weight.

The common pump and overhead mounted motor base shall be a minimum of 3/8-inch thick fabricated steel, suitably constructed to support the full weight of pump and motor. Belts and sheaves shall be provided to drive the pump at a speed to meet rated conditions. An enclosed belt guard of fabricated steel or reinforced fiberglass shall be provided.

2.4.3 Spare Parts

One set of manufacturer's spare pump parts shall be provided for each pump in labeled, wood boxes, with moisture protection and contents labeled. The following spare parts shall be provided for each pump and stored in protective containers.

Mechanical Seals	1 each
Shaft Sleeves	1 each
Gaskets/O-rings	1 set
Bearings	1 set

2.5 MOTORS

The pump motor shall be standard horizontal, TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI and IEEE standards. Motor shall be constructed with Class B or F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplate rating shall be 460 volts AC, 3 phase, 60 HZ, continuous duty at 40°C ambient air temperature with a 1.15 service factor.

Motor horsepower shall be as follows:

Sludge Transfer Pump:	7.5
Digester Recirculation Pumps:	7.5
Thickened Sludge Pumps:	7.5
Scum Pump:	3
Grit Pumps:	10

Motors shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the project.

The motor windings for the grit pump shall be provided with thermal overtemperature detection switches (normally closed) embedded in each phase of the motor windings. The detectors shall be suitable for connection directly to 120 VAC control circuits.

2.6 FACTORY PUMP TESTS

One pump of each model shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

2.7 NAMEPLATES

Pumps and motors shall have a nameplate affixed to the unit in a conspicuous place. All nameplates shall be of stainless steel suitably attached to the pump. Nameplates shall contain the manufacturer's name, pump or motor size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

A special nameplate shall be attached to the pump frame which shall contain identification of frame and bearing numbers.

2.8 PAINTING

Pumps and motors shall be thoroughly cleaned, surface prepared, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not finished at the factory is specified in Section 09900.

2.9 ANCHOR BOLTS

Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be 316 stainless steel unless noted otherwise. Anchor bolts shall be L-type embedded or threaded stainless steel rod with adhesive anchors, as approved by the Contract Officer. Expansion-type anchors will not be acceptable.

Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

3 EXECUTION

3.1 GENERAL

Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.

3.2 TESTS

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

3.3 FIELD PAINTING

Factory painted items requiring touch-up painting in the field shall be thoroughly cleaned of all foreign matter and shall be primed and top-coated in accordance with Section 09900.

3.4 MANUFACTURER'S REPRESENTATIVE

The services of a factory trained representative of the pump manufacturer shall be provided. Services shall include the amount of days shown below on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment, and the cost of these services shall be included in the bid price. Instruction shall not take place until start-up is completed and the pumps are fully operational. At least four (4) hours of the manufacturer's representative's time shall be dedicated to operation and maintenance training.

One Site Service Time:

Dry-Pit Centrifugal Pumps	One-day
Rotary Lobe Pumps	Two-days (two visits)
Recessed Impeller Centrifugal Pumps	Two-days (two visits)

END OF SECTION

~~SECTION 11315~~

~~RECESSED IMPELLER CENTRIFUGAL PUMPS~~

~~1 GENERAL~~

~~1.1 REFERENCES~~

~~The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.~~

~~AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)~~

~~ASTM A 48 (2000) Gray Iron Castings~~

~~ASTM A108 (1999) Steel Bars, Carbon, Cold Finished, Standard Quality~~

~~ASTM A 532 (1999) Abrasion-Resistant Cast Irons~~

~~ASTM A 582 (2000) Free Machining Stainless Steel Bars~~

~~NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)~~

~~NEMA ICS 1 (1993) Industrial Controls and Systems~~

~~NEMA MG 1 (1993; Rev 1; Rev 2; Rev 3; Rev 4) Motors and Generators~~

~~1.2 SUBMITTALS~~

~~Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:~~

~~Shop Drawings~~

~~Equipment Installation; G~~

~~Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.~~

~~Product Data~~

~~Pump System; G~~

~~Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent (100 percent for positive displacement pumps) of design capacity. A complete list of equipment and material, including manufacturer's~~

~~descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.~~

~~Spare Parts; G~~

~~Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.~~

~~Pump System; G~~

~~Diagrams, instructions, and other sheets proposed for posting.~~

~~Test Reports~~

~~Field Testing and Adjusting Equipment; G~~

~~Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.~~

~~Operation and Maintenance Data~~

~~Pump System; G~~

~~Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step by step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course.~~

1.3SCOPE

~~There shall be furnished and installed two (2) new overhead mount, belt driven, dry pit recessed impeller centrifugal pumps at the headworks as shown on the Plans and specified herein. These pumps shall be capable of pumping grit containing solids, rags and other fibrous materials.~~

1.4EQUIPMENT LIST

~~Equipment numbers are as follows:~~

Item	Equipment Number
Grit Pump No. 1	01 GP 01
Grit Pump No. 2	01 GP 02

1.5 PERFORMANCE REQUIREMENTS

Each Primary Sludge Pump shall be capable of meeting the following performance requirements:

<u>Capacity</u>	<u>Total Head (Feet)</u>
Shut-off, 0 gpm	36
Design operating point, 125 gpm	32
Maximum RPM	1,000 rpm

Each pump shall be capable of freely passing a three-inch diameter, non-compressible sphere.

1.6 EXPERIENCE REQUIREMENTS

All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Government that the quality is equal to equipment made by that manufacturer if specifically named herein. Manufacturers shall provide evidence of at least five (5) installations in which identically sized equipment has provided satisfactory performance for a minimum of five (5) years in a similar application. No consideration will be given to an individually sized piece of equipment that has not been commercially available for five (5) years.

1.7 PUMP WARRANTY

The pump manufacturer shall warrant the units being supplied to the Government against defects in workmanship and material for a period of one (1) year under normal use, operation, and service. The warranty shall be in printed form and apply to all similar units.

2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Grit Pumps shall be Wemco Model C overhead mount, belt driven pumps with 3-inch suction and discharge connections and a 13.875-inch diameter impeller or Hayward-Gordon Torus Model XR3-11, or approved equal. Any other manufacturers must be pre-qualified.

2.2 PUMPS

The pumps shall be of a fully recessed, Slurry Type design, with the impeller mounted completely out of the flow path between the pump inlet and discharge connections, so that solids are not required to flow through the impeller. All flow path clearances within the pumps shall be equal to or greater than the discharge diameter, so that all solids, which will pass through the discharge, will pass through the pump. The pumps head capacity curve shall slope upward toward shutoff in one continuous curve with no points of inflection capable of causing hunting at any pump operational speed.

The pumps shall be specifically designed to pump slurries of grit, debris and organic solids. Pumps shall be evaluated on the following elements:

1. Materials of construction of the wearing parts.
2. Thickness of component wearing parts.
3. Hydraulic design for wear minimization.
4. Mechanical design for overall ruggedness and simplicity of maintenance.

~~All cast parts exposed to wear shall be constructed of Ni Hard material, conforming to ASTM A532, Class I and be a minimum of 650 BHN. Brinell values below this are not acceptable.~~

~~The following minimum thickness and weights of component wearing parts shall be furnished for cup-type impeller pumps:~~

1. Minimum casing thickness	9/16 inch
2. Minimum suction piece thickness at wear area	1 inch
3. Minimum impeller vane thickness at wear area	7/8 inch
4. Minimum impeller shroud thickness at wear area	1 1/8 inch
5. Minimum weight of wearing parts (suction piece, impeller, casing and wearplate)	340 pounds

~~The following minimum thicknesses of wearing parts shall be furnished for radial vane impeller pumps:~~

1. Minimum casing thickness	1/2 inch
2. Minimum impeller vane front edge thickness	1/2 inch
3. Minimum radial wear element base thickness	1 1/8 inch
4. Minimum radial wear element tip thickness	3/4 inch
5. Minimum suction wear piece thickness	7/8 inch

~~For pumps with radial vane impellers, the pump casing shall consist of one piece casting with integral suction and discharge nozzles plus a backplate with integral wear element. The casing will have cast-on feet, which will fully support the volute, to allow removal of the complete rotating assembly, without disturbing suction or discharge piping.~~

~~Machined registers or other joints between wear parts shall not be located in any area subjected directly to wear, such as the suction piece to casing fit, or the casing to wearplate or backplate fit.~~

~~For pumps with cup type impellers, the pump casing shall be of the two piece, radially split type, with a separate and removable suction piece designed so that the impeller can be withdrawn without the need to remove the discharge casing or disturb the discharge piping. The casing shall be constructed so that it can be reversed for opposite rotation, and shall be of Ni Hard.~~

~~For pumps with radial vane impellers, the pump casing shall consist of a one piece casting with integral suction and discharge nozzles plus a backplate with integral wear element. The casing will have cast on feet, which will fully support the volute, to allow removal of the complete rotating assembly, without disturbing suction or discharge piping.~~

~~For pumps with cup type impellers, the hydraulic design of the impeller shall be such that fluid flow is directed to the suction piece, which shall be designed as a sacrificial part and be easily replaceable. The impeller shall be of Ni Hard and of the cup type design, such that the vane ends are surrounded by an integral shroud.~~

~~Pumps with radial vane impellers shall be fully recessed out of the casing passage. Impeller shall be fitted with back pumpout vanes to restrict flow behind the impeller and shall be keyed to the shaft and secured by a shrouded security bolt and lock washer.~~

~~Pumps with radial vane impellers shall be fitted with a rear casing wear plate and integral radial wear element which will protect the area behind and at the periphery of the impeller from the brunt of the~~

~~abrasive wear. The radial wear element shall be of tapered design to promote flow of solids out of the impeller recess.~~

~~For pumps with cup type impellers, a removable wearplate of Ni Hard shall be provided in back of the impeller designed to direct flow from behind the impeller to the center of the volute for maximum protection to the casing. The packing housing shall be a separate piece bolted to the bearing housing for ease of removal.~~

~~Pumps shall be equipped with slotted raised face flanges to receive 125 pound standard bolting. Special case slots shall be cast in to retain bolts and to fasten the case to the bearing housing and to the intake for easy case removal.~~

~~The shaft shall be of ASTM A108, Grade 1141 or 4140 steel, and shall be protected throughout the packing area by a removable, hardened stainless steel shaft sleeve conforming to ASTM A582 Type 416. The pumps shall be supplied with a backplate constructed of ASTM A48 Class 30 Grey Iron.~~

~~A single cartridge mechanical seal requiring no external flushing shall be furnished in the pump. The seal shall utilize a tungsten carbide rotational sealing ring mounted in an elastomer cup with an o ring mounted silicon carbide stationary ring loaded by a non fouling, conical spring encapsulated in Viton. Installation of the seal shall require no measurements or scribe marks on the shaft.~~

~~Bearings shall be oil bath lubricated. The oil reservoir shall be sealed at both ends to prevent entrance of foreign matter. The thrust bearings shall consist of three angular contact ball bearings for maximum protection from all thrust loads. The bearing housing will be equipped with a pressure venting device and oil fill, and drain taps. A built in sight glass shall be furnished to check proper oil level. The bearings shall be rated for a minimum B10 life of 100,000 hours, based on calculated loads due to hydraulic thrust at the duty point as well as other mechanical loading due to belt drives or shaft and impeller weight.~~

~~The common pump and overhead mounted motor base shall be a minimum of 3/8 inch thick fabricated steel, suitably constructed to support the full weight of pump and motor. Belts and sheaves shall be provided to drive the pump at a speed to meet rated conditions. An enclosed belt guard of fabricated steel or reinforced fiberglass shall be provided.~~

~~2.3MOTOR~~

~~The motors for the primary sludge pumps shall be standard horizontal, TEFC electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, B-30,000 anti friction bearings, cast iron frame and end bells. The motor nameplate rating shall be a maximum of 7.5 HP, 460 volts AC, 3 phase 60 Hz, 1800 RPM, continuous duty at 40°C ambient air temperature with a 1.15 service factor. The motors shall meet the minimum full load efficiency requirements of the Washington State Non-Residential Energy Code.~~

~~The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the windings. Detectors shall be suitable for operation with 120-volt AC control circuits, Klaxon, or equal.~~

~~The motors shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the project.~~

~~The motors shall be rated "Inverter Duty" suitable for operation with the variable frequency drives specified in Division 16, ELECTRICAL, and shall be coordinated with the thermal, mechanical, and electrical characteristics of, the drives actually supplied. The motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (1600 volts minimum) for VFD operation.~~

~~2.4PUMP TEST~~

~~A.FACTORY TESTS~~

~~The pumps shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.~~

~~B.SITE TESTS~~

~~Each pump shall be tested at startup, and voltage, current, capacity, and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording data.~~

~~2.5SPARE PARTS~~

~~One set of manufacturer's spare pump parts shall be provided for each pump in labeled, wood boxes, with moisture protection and contents labeled. The following spare parts shall be provided for each pump and stored in protective containers:~~

Mechanical Seals	1 each
Shaft Sleeves	1 each
Gaskets/O-rings	1 set
Bearings	1 set

~~2.6PAINTING~~

~~Pumps and motors shall be painted in accordance with Section 09900 of these Specifications.~~

~~3EXECUTION~~

~~3.1GENERAL~~

~~Pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's recommendations. Pumps bases shall be securely anchored to the concrete equipment pad using stainless steel bolts and stainless steel expansion anchors.~~

~~The Primary Sludge Pumps shall be mounted in the horizontal position with the motor mounted overhead and coupled to the pump by belts.~~

~~All pumps shall be checked for rotation prior to operation. When pumps are put into service, amperage draw on each phase of power shall be checked and recorded immediately. The results of these tests shall be submitted to the Owner.~~

~~3.2MANUFACTURER~~

~~The services of a factory trained representative of the pump manufacturer shall be provided. Services shall include two days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment, and the cost of these services shall be included in the bid price. Instruction shall not take place until start-up is completed and the pumps are fully operational.~~

~~END OF SECTION~~

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SECTION 11336

GRAVITY THICKENER MECHANISM

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN GEAR MANUFACTURER'S ASSOCIATION

AGMA 2001-B88 Tooth Thickener Specification and Measured

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

NEMA ICS 6 (1993) Industrial Control and Systems, Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Equipment Installation; G

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the drive mechanism has been coordinated with the existing bridge and scrapper, and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances to existing equipment, and equipment relationship to other parts of the work including clearances for maintenance and operation.

Product Data

Equipment; G

A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, wiring diagrams, and installation instructions.

Operation and Maintenance Data

Gravity Thickener Mechanism; G

See Section 01701 for requirements.

1.3 SCOPE

There shall be furnished and installed equipment for one (1) circular scraper, bridge supported, shaft drive gravity thickener as shown on the Plans and specified herein.

The equipment shall include a centernew drive unit ~~and torque control, walkway and platform with handrail, stationary influent pipe, center feedwell, rotating drive shaft, spiral shaped rake arms with pickets, scum skimmer, scum box, weir, baffle, anchor bolts, including drive gears, gear reducer, overload device, motor,~~ and all other appurtenances required or shown on the Plans.

~~The thickener mechanism shall be of the center drive type, supported on a stationary influent column, with the flow entering at the bottom of the inlet column and flowing upward to openings near the water level. The thickener shall be designed to remove settled sludge uniformly from the bottom of the tank.~~

1.4 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Gravity Thickener Mechanism No. 1	05 GTM 01

1.5 PERFORMANCE REQUIREMENTS

The gravity thickener mechanism shall be meet the following design conditions.

Minimum Motor Hp	1.5
Torque (ft-lbs)	
Design Running	21,400
Momentary Peak	42,800

1.6 EXPERIENCE REQUIREMENTS

The equipment supplier shall have at least 15 years experience in the design, application, and supply of circular thickeners in water or wastewater treatment plants, and shall submit a list of not less than 25 operating installations as evidence of meeting the experience requirement.

1.7 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The thickener equipment specified in this section shall be as manufactured by WesTech Engineering, Inc. or Eimco Process Equipment Company or U.S. Filter/Envirex, or equal.

2.2 DRIVE UNIT

A. DESIGN PARAMETERS

The drive unit shall be manufactured by the thickener equipment supplier to ensure unit responsibility. The drive unit shall be designed for torque values of 21,400 ft-lb. It shall turn the mechanism at the design collector tip speed. The drive bearings shall be designed for the total rotating weight with a minimum L-10 life for continuous operation of 50 years or 450,000 hours. The drive unit shall be capable of producing and withstanding a momentary peak (stalled) torque of 42,800 ft-lb. while starting. The drive gear shall be designed to a minimum AGMA 5 rating when rated in accordance with AGMA 2001-B88. The design running torque rating of the drive shall be based on the smaller of the two values determined from the above AGMA standard.

All gearing shall be designed per the latest edition of the AGMA standards for strength and durability, based on a life of 175,000 hours at the design running torque rating of the drive unit. Any and all welding on the drive unit shall be done using E70XX weld rod, and shall be performed utilizing a weld positioner, such that all welding is done in the most advantageous position (flat horizontal).

B. PHYSICAL CHARACTERISTICS

The drive unit shall consist of a solid external main gear, turntable, pinion, secondary speed reducer, support base, and drive unit bearing. The drive shall be mounted on the existing operating platform frame and support the entire rotating load of the mechanism. The main internal gear shall be forged of alloy hardened steel. The pinion shall be heat treated alloy steel. All speed reducers shall be fully enclosed and running in oil or grease. Support base for the drive shall be of welded steel to assure rigidity. All mating parts shall be machined to insure accurate fit and maintain precise clearances of gears and moving parts. Oil and dust shields shall be provided. The drive bearing shall include a hardened replaceable raceway, or it shall be a forged steel precision gear/bearing set, with fully contoured raceways. The main gear and pinion shall run in an oil bath or be grease lubricated. An oil sight glass shall be provided for the reservoir. Readily accessible lubricant fill and drain pipes with necessary fittings shall be provided. Lubrication fittings shall be readily accessible.

2.3 OVERLOAD PROTECTION

The overload device shall be provided in a stainless steel, weatherproof enclosure. The device shall be actuated by torque from the rotation of the secondary gear reducer, which shall operate two independently adjustable switches (the alarm switch at 120 percent of design running torque and the motor cutout switch at 140 percent of design running torque). These two switches shall be factory adjusted to accurately calibrate the alarm torque value and the overload position. Switches shall be single pole, double throw rated 10 amperes at 120 volts with NEMA 4X enclosures. A visual torque dial indication shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.

2.4 TURNTABLE

The turntable base shall have an annular raceway for a ball race upon which the rotating assembly rests. It shall have a maximum allowable deflection in accordance with the bearing specifications. The allowable modulus of elasticity shall be a minimum of 29×10^6 psi. The center cage shall be fastened to

and supported from the gear casing. Ball bearings shall be of the highest quality high carbon chrome alloy steel running in fully contoured races, as part of a precision gear/bearing set. Alternatively, the ball bearings shall bear horizontally and vertically on four renewable hardened alloy steel race liners. The balls shall be grease or oil lubricated and protected by elastomer seals. Oil lubricated bearings shall be provided with a fill pipe, plug, sight gauge indicator, and drain plug.

2.5 SPEED REDUCING UNIT

The speed reducing unit shall consist of cycloidal or helical speed reducers directly connected to a motor without the use of chains or v-belts and shall be keyed to the pinion.

The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the high speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The teeth of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low speed shaft.

Speed reducer helical gearing shall be manufactured to AGMA standards and bear an AGMA nameplate. The speed reducer shall have a service factor of 1.25. The pinion shall be supported radially by a bearing at the bottom end. No overhung pinions shall be allowed on the speed reducing unit. The lower pinion bearing shall not be located below the turntable base.

The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and run in a totally submerged oil bath or be grease lubricated.

2.6 MOTOR

The motor shall be a standard, TEFC, electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI IEEE standards. Motor shall be constructed with Class B or F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplate rating shall be 460 volts AC, 3 phase, 60 HZ, 1800 RPM, continuous duty at 40°C ambient air temperature with a 1.15 service factor. The motor shall be sized by the thickener manufacturer and be a minimum of 1.5 HP.

Motor shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the project.

2.7 PAINTING

The new drive unit may be shop coated or field painted in accordance with Section 09900, non-submerged metal, severe conditions. The remainder of the thickener shall be field painted in accordance with Section 09900.

3 EXECUTION

3.1 GENERAL

The thickener drive mechanism shall be installed on the existing scrapper mechanism for the existing gravity thickener as shown on the Plans and in accordance with the manufacturer's recommendations.

3.2 MANUFACTURER'S REPRESENTATIVE

A representative of the thickener drive mechanism manufacturer shall be provided to inspect the drive installation, make any field adjustments necessary to ensure proper operation, and instruct the Owner's personnel on proper operation and maintenance. Manufacturer's services shall include 2 days at the site (two visits) and shall be included in the bid price.

END OF SECTION

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SECTION 11337

SECONDARY CLARIFIER EQUIPMENT

1 GENERAL

1.1 REFERENCES

Not Used.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Equipment Installation; G

Drawings containing complete equipment schematic diagrams and any other details required to demonstrate that the has been coordinated with the existing secondary clarifiers, and will properly function. Drawings shall show proposed layout and anchorage of equipment and appurtenances to existing equipment, and equipment relationship to other parts of the work.

Product Data

Equipment; G

A complete list of equipment and material, including manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions.

Operation and Maintenance Data

Operation and Maintenance Instructions; G

See Section 01710 for requirements.

1.3 SCOPE

There shall be furnished and installed one scum skimmer assembly and one algae sweep system on the scum skimmer arm of each of the two existing secondary clarifiers.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2 PRODUCTS

2.1 SCUM SKIMMER ASSEMBLY

A hinged scum skimmer assembly shall be mounted on the outer end of each skimming device. The hinged scum skimmer assembly shall be designed to form a pocket for trapping the scum. The hinged arrangement shall insure continual contact and proper alignment between wiper blade, scum baffle, and ramp as the blade travels up the ramp. The wiper blade shall have a wearing strip on its outer end which contacts the scum baffle and a neoprene strip on its lower and inner edge. The scum is trapped as the wiper blade meets the ramp and is raised up the ramp to be dumped into the scum trough for disposal. The scum skimmer assemblies shall be as manufactured by WesTech Engineering, Inc., Eimco Process Equipment Company or US Filter/Envirex, or equal.

2.2 ALGAE SWEEP SYSTEM

2.2.1 General

The algae sweep system shall be custom designed, constructed, for the removal of algae and debris and installed on a circular clarifier.

The algae sweep system shall be designed to clean the following surfaces: inner baffle, outer baffle, inner weir, outer weir, top spillway surface, angled spillway surface, inner launder wall, launder bottom, outer launder wall.

The algae sweep system shall be designed to work off the power of the existing clarifier drive motor. The system shall be constructed to avoid any noticeable torque increases. The unit shall be capable of encountering an indefinite stall without incurring damage.

The unit shall be designed with an engaged position for cleaning, and a disengaged position allowing the system to ride idle around the tank.

2.2.2 Attachment Assembly

The attachment assembly shall provide a means of attaching the algae sweep system to the skimmer arm and or rake truss so as not to interfere with any other operations of the skimmer arm (such as the effective skimmer of floatable solids or the operation of the skimmer blade assembly at the scum box).

The attachment assembly shall be custom designed for each specific clarifier. It shall be constructed of carbon steel.

2.2.3 Mainframe

The algae sweep system mainframe shall be constructed of Type 304 stainless steel and designed to slip easily into the attachment assembly and be tightened in position with the use of the set screws.

The mainframe shall be designed so that the brush arms can be positioned at any point on the mainframe.

2.2.4 Brush Arms

All algae sweep system brush arms shall be of Type 304 stainless steel and custom designed and installed. A factory service technician from the supplier shall be on-site to observe and advise the installation of the brush arms to allow for cleaning all aforementioned surfaces and allow for the following:

- Flexibility to clean effluent surfaces within a plus or minus 4 inch radial variance (specifically: clarifier walls, weirs, and baffles).
- To allow brush holder to be adjusted telescopically so that a maximum number of brush arm adjustments are possible.
- To have opposite the mainframe end, a brush holder attachment allowing for the insertion of a brush.
- To have a means of biasing the arm to the mainframe so as to provide sufficient force to remove algae and debris.

2.2.5 Brushes

Brushes shall be provided that slip easily into the brush holder and provide the cleaning means necessary to remove algae and debris from their respective surfaces.

Brush construction shall be as follows:

- Brush backing shall be of durable plastic able to withstand continuous exposure to sunlight, seasonal temperature changes and the corrosive elements found in wastewater.
- Brush bristles shall be polypropylene with adequate trim length, density, and stiffness for extended continuous use.
- Brushes shall be cut and shaped appropriately so as to clean their respective surfaces without binding.

Replacement brushes shall be stocked and provided by the manufacturer to the exact dimensions needed. Average brush life shall be at least eight months.

2.2.6 Brush Bridge

Provides the algae sweep system launder brush assembly a “bridge” over the effluent hole on which to travel.

The brush bridge shall be constructed entirely out of Type 304 stainless steel.

2.3 PAINTING

The scum skimmer assemblies unit may be shop coated or field painted in accordance with Section 09900, non-submerged metal, severe conditions.

2.4 SPARE PARTS

One complete set of brushes for algae sweep system.

2.5 EFFLUENT WEIR AND SCUM BAFFLE

The scum baffle shall consist of curved sections of 1/4-inch thick by 12-inch deep stainless steel or aluminum plate or fiberglass attached to the tank wall with special L-shaped brackets fabricated from stainless steel or aluminum angles or fiberglass with 316 stainless steel hardware and 316 stainless steel threaded rods in epoxy anchors and hex nuts, to enable vertical and radial adjustment.

The effluent weir shall consist of 1/4-inch thick by 9-inch deep stainless steel or aluminum plate or fiberglass sections with 2-1/2-inch deep 90 degrees v-notches at 6-inch intervals. The weir sections shall be curved and fastened to the tank wall with special large-diameter 316 stainless steel washers, 316 stainless steel threaded rods in epoxy anchors and hex nuts to allow vertical adjustment. Non-set mastic gaskets shall be applied between the weir plate and the concrete.

3 EXECUTION

3.1 GENERAL

The scum skimmer assemblies and algae sweep systems shall be installed on the existing scrapper mechanism for the existing secondary clarifier as shown on the Plans and in accordance with the manufacturer's recommendations.

3.2 MANUFACTURER'S REPRESENTATIVE

A representative of the algae sweep system manufacturer shall be provided to supervise the installation, make any field adjustments necessary to ensure proper operation, and instruct the Owner's personnel on proper operation and maintenance. Manufacturer's services shall include 2 days at the site (two visits) and shall be included in the lump sum bid price.

END OF SECTION

SECTION 11380

DIGESTER GAS HANDLING AND HEATING SYSTEM

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1997a) Carbon Structural Steel
ASTM A 53	(1998) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASME INTERNATIONAL (ASME)

ASME B31.1	(1998) Power Piping
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code-Steel
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(1993) Industrial Controls and Systems
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contractors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 3	(1993) Industrial Control and Systems Factory Built Assemblies
NEMA ICS 4	(1993) Industrial Control and Systems Terminal Blocks
NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA MG 1	(1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFP A)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 508 (1993; Rev thru Oct 1997) Industrial Control Equipment

UL 845 (1995; Rev Feb 1996) Motor Control Centers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Equipment Installation; G

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation. Control Panel wiring diagrams for the boilers and waste gas burner shall also be submitted.

Product Data

Waste Gas Burner System; G

A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Digester Heating System; G

A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Digester Gas Handling Equipment; G

Manufacturer's literature, catalog cuts, and installation instructions for all.

Spare Parts; G

Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Test Reports

Factory Tests; G

Factor test reports for all control panels shall be submitted and approved prior to installation.

Inspection Report; G

Boiler inspection reports shall be furnished prior to installation.

Field Testing; G

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls. Boiler test reports shall include manometer readings at the main gas regulator, pilot gas regulator, burner inlet, burner and the furnace; amperes drawn by all motors; voltage of main flame and pilot controller signal; and flue gas readings including percent oxygen, percent carbon dioxide, temperature, efficiency, and smoke test results.

1.3 SCOPE

There shall be furnished and installed equipment for two (2) Digester Sludge Heating systems. The equipment shall include two (2) fire tube boilers, two (2) water circulating pumps (specified elsewhere), two (2) circulation water control valves, four (4) digester recirculation pumps (specified elsewhere), one (1) waste gas burner and controls, digester temperature controls, boiler controls, (1) pressure tank, (2) air separators, (2) air eliminators, (1) manual shot feeder, anchor bolts, piping and all other appurtenances required as shown on the Plans and specified herein. The digester sludge heating system shall incorporate the two (2) existing spiral heat exchangers as shown on the Plans. The Contractor shall be responsible for providing a complete and operable Digester Heating System.

There shall also be furnished and installed one (1) Digester Waste Gas Burner and Pilot Ignition System. The equipment shall include the waste gas flares, ignition system, flame trap, thermal shutoff valve, controls, piping, valves and all other appurtenances required or shown on the Plans and specified herein. The Contractor shall be responsible for providing a complete and operable Digester Waste Gas Burner System.

1.4 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.2 MATERIALS

Materials and equipment shall conform to the following respective publications and other specified requirements.

2.2.1 Steel Shapes, Plates and Bars

Steel shapes, plates, and bars shall conform to ASTM A 36.

2.2.2 Digester Gas Pipe and Fittings

As specified in Section 15200.

2.2.3 Sludge Piping

As specified in Section 15200.

2.2.4 All Other Piping

As specified in Section 15200.

2.2.5 Valves

2.2.5.1 Water, Sludge, and Gas Valves

As specified in Section 15200.

2.2.5.2 Temperature Regulating Valves

The boiler hot water recirculation system shall be provided with two (2) temperature regulating thermostatic valves placed in the boiler water circulation line. The control valves shall use 180°F boiler water and cold heat exchanger water to limit the hot water flowing to the existing heat exchangers to a temperature of 158°F to reduce the chances of the sludge baking onto the heat exchanger tubes and thus reducing the heating capacity of the existing heat exchanger.

The temperature regulating valves shall be 4-inch, flanged, 3-way mixing, sliding piston valves.

2.2.6 Expansion Joints

As specified in Section 15200.

2.2.7 Pipe Hangers and Supports

As shown on the plans and as specified in Section 15200.

2.3 DIGESTER GAS HANDLING SYSTEM

2.3.1 Flame Check Valves

Flame check valves shall be provided in the gas piping system where shown. Flame check valves shall block flame return and shall have threaded end connections of the size as shown. Flame check valves shall be Varec Series 52200, or equal.

2.3.2 Flame Traps

Flame traps shall be provided in the gas piping system where shown on the Drawings. Each flame trap shall have a capacity to pass at least 10,000 cubic feet of gas per hour at a pressure loss not to exceed 3 1/2 inch of water column.. The flame trap element shall prevent the passage of flame and shall permit convenient replacement of the entire element. The unit shall also include a spring actuated thermal shut-off valve, held open by a fusible element, to automatically close in the presence of burning mixtures. Flame trap assemblies shall be Varec Series 450, or equal, and shall have the following features:

- A. Spring actuated thermal valve
- B. Isolated sight glass and indicator rod
- C. Removable fusewell
- D. Extensible bank assembly; aluminum
- E. Low copper 356 HT aluminum construction
- F. Drilled to ANSI 125 dimensions, flat face flange
- G. Location and size as shown on the Plans
- H. Vertical mounting

2.3.3 Relief Valve and Flame Arrester Unit

Pressure and vacuum relief valve with flame arrester shall have flanged connections as shown on the Drawings. Pressure relief valve shall be set at 15 inches WC. Vacuum relief shall be set at 2 inches W.C.

Relief valve and the flame arrester shall be two independent items of equipment. Valve shall be field installed on the flame arrester by means of a bolted and gasket flanged connection.

Pressure and vacuum ports shall be oversized to keep overpressure to a minimum. Pallets and seat rings shall be replaceable and interchangeable. Pallets shall be dead weight loaded, and both center and side guided for stability. The shall incorporate replaceable "air cushion" Teflon seat inserts. Pressure pallet shall include removable loading weights for adjusting from 4 inches to 15 inches WC in

1 inch increments. HDPE protective screens shall be provided at the pressure and vacuum ports, located external of the pallets.

The valve body and cover shall be of 356-T6 low copper cast aluminum construction. Spun hood, seat rings, and pallet assemblies shall be low copper aluminum. Guide posts shall be 316 stainless steel.

Provide the “all-weather” model with special non-frosting and icing resistant coating.

Net free area through the bank assembly shall be not less than three times the corresponding size standard pipe. Flame arrester housing shall be equipped on two sides with removable aluminum side plates. Entire bank assembly shall slide easily out of the arrester housing to facilitate inspection and cleaning. Removing or replacing the bank assembly shall not require support for alignment, jack screw for extending the housing, and shall not place a strain on the connecting piping. Bank frame shall be extensible and shall be filled with corrugated rectangular shaped bank sheets. Sheets shall be arranged for individual removal. Flame arrester shall be self draining.

Housing construction shall be 356-T6 low copper cast aluminum. Bank assembly shall include a low copper aluminum frame and low copper aluminum bank sheets. Flanges shall be drilled to ANSI 125 dimensions.

Relief valve and flame arrester combination shall be Whessoe Varec 5811 WT Series.

Relief valves shall vent to atmosphere, and shall have an aluminum body and frame, and teflon inserts.

2.3.4 Drip Traps

Drip traps shall be provided in the gas piping network at the low points. Trap construction shall effectively prevent leakage of gas from the system when the trap is being drained. Drip traps shall be Varec Series 246, or equal.

Drip traps shall be constructed of 356HT low copper cast aluminum body and handle, anodized cast aluminum cover plate and disc, neoprene “O” rings and stainless steel internal working parts and hardware. Inlet and outlet connections shall be 1-inch NPT. Condensate reservoir capacity shall be a maximum of 2-quarts.

2.3.5 Gas Meters

As specified in Section 13427.

2.3.6 Pressure Indicating Gauges

Pressure indicating gauges shall be provided in the gas piping system to enable monitoring of digester pressure and to enable the pressure balancing at the waste gas burner and the digester heating system. Gauges shall be direct reading in inches of water and shall be individually mounted on the pipe with shut-off cocks. Shut-off cocks shall be pinned and sealed to prevent gas leakage.

2.3.7 Waste Gas Burner and Ignition System

The system shall be a combination flare and ignition system to burn excess waste digester gas and shall have the following features:

A. Size:	4-inch
B. Burning Capacity:	22,250 CF/HR at 60°F and 14.7 PSIA
C. Connection:	150 LB ANSI raised face flange
D. Controller:	120VAC, 60- Hz
E. Remote Alarm Contacts:	SPDT, 2 amps, 120VAC, NC, pilot out and system alarm
F. Controller Enclosure:	NEMA 4X
G. Materials of Construction:	Manufacturer's standard
H. Waste Gas:	Digester gas
I. Pilot Gas:	Propane gas, 4—10 psig
J. Auto-Start:	Dry contact NEMA 7 pressure switch located where shown on the Plans, 4 to 20-inch WC range, set at 14-inches WC
K. Pilot Solenoid:	Fail closed
L. Blower Package	Manufacturer's standard with explosion proof motor and regulator for constant gas supply
M.L. Heater:	Not required

The system shall be as manufactured by Whessoe Varec, 244WGS Series.

The pilot system shall provide a stoichiometric air/fuel mixture by utilizing two venturies. Pilot flame shall be monitored through a thermocouple installed on the pilot nozzle. The continuous pilot shall have a pilot flame profile longer than the width of the stack and an approach angle of 30 degrees or more to the waste gas exist profile to ensure waste gas combustion regardless of flow rates.

2.3.8 Boilers

2.3.8.1 General

The boilers shall be of the capacity to develop the specified boiler capacity and shall have dual fuel, combination burners. The boilers shall include equipment for burning either digester gas, with heat content of approximately 600 Btu per cubic foot and a specific gravity of 0.8, or LP propane with heat content of 2,488 Btu per cubic foot. Gas piping and equipment for LP propane shall conform to NFPA 58. The boilers will be part of a digester heating system that will utilize the two (2) existing spiral heat exchangers.

2.3.8.2 Approved Manufacturers

The Digester Heating System Boilers shall be Cleaver Brooks Model CB, Fuel Series 700, 50 hp or equal.

2.3.8.3 Equipment List

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Boiler No. 1	09 BR 01
Boiler No. 2	09 BR 02

2.3.8.4 Performance Requirements

The Digester Sludge Heating System shall meet the following performance requirements.

Heat Transfer Capacity (BTU/hr.)	
Boiler when fired with natural gas (each)	1,674,000
Boiler Water Circulating Pump	
Capacity (gpm), each	180
Digester Gas Operating Range	
Min, Inches of W.C.	5
Normal, Inches of W.C.	12
Max, Inches of W.C.	14
Propane Pressure (psig)	4 to 10

The boiler shall provide the heat transfer capacity specified above to maintain the temperature of the sludge in the primary digesters at temperatures up to 95°F. The new boilers and existing heat exchangers shall be capable of heat transfer at the listed capacities with a Log Mean Temperature Difference (LMTD) of not more than 50°F.

2.3.8.5 Factory Assembly

The boiler system specified herein shall be completely factory assembled as one unit. All mating parts shall be trial fit and match-marked at the factory. The manufacturer shall submit certification of factory assembly to the Owner before shipment.

2.3.8.6 Fabrication

All structural steel shall conform to the requirements of ASTM A36. Steel pipe used for structural members shall conform to ASTM A53. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4-inch. All aluminum shall be type 5052, 6061, or 6063 alloy unless noted. All field assembly bolts, nuts, and washers shall be ASTM A307 unless otherwise noted. Anchor bolts shall be type 316 stainless steel.

Shop fabrication and welding of structural members shall be in accordance with the latest edition of the "Structural Welding Code", AWS D1.1, of the American Welding Society. All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16-inch fillet weld. Skip welding will not be allowed. All welding shall be done in accordance with the latest edition of the AWS code.

2.3.8.7 Boiler Design

The boilers shall be of the packaged, fully automatic, four pass horizontal firetube updraft boiler type for water heating. The units shall be of the size as specified herein and of the capacity listed. The boilers shall be mounted on a heavy steel frame and shall have integral forced draft burners and burner controls.

The boilers shall contain not less than five square feet of ASME fireside heating surface per rated boiler horsepower. The boilers shall be designed, constructed, and tested in accordance with the

ASME Boiler and Pressure Vessel Code. The boilers shall be designed for 30 psig water in accordance with Section IV ASME Code and must receive authorized boiler inspection prior to shipment. A copy of the inspection reports shall be furnished to the Contracting Officer.

The boilers shall be completely preassembled and fire tested at the factory. The unit shall be ready for immediate mounting on its equipment pad and ready for attachment of water, fuel, electrical, vent, and blowdown connections.

The hot water return and outlet connection shall be located on the top center line of the boiler. The boiler shall be designed to rapidly mix the return water with the boiler water. Forced internal circulation shall be used. A dip tube shall be included as an integral part of the water outlet.

Two lifting eyes shall be located on top of the boiler assembly.

Front and rear doors on the boiler shall be davited. Doors are to be sealed with fiberglass tadpole gaskets and fastened tightly using heavy capscrews that thread into replaceable brass nuts. Rear refractory and insulation shall be contained in the formed door, which must swing open for inspection of brick work.

The boiler tubes shall not include turbulators, swirlers or other add-on appurtenances.

Front and rear tube sheets and all flues must be fully accessible for inspection and cleaning when the doors are swung open. The shell must be furnished with adequate handholes to facilitate boiler inspection and cleaning.

The exhaust gas vent shall be located near the front of the boiler on the top center line and shall be capable of supporting 1,000 lbs and shall contain a stack thermometer.

Observation ports for the inspection of flame conditions shall be provided at each end of the boiler.

The boiler insulation shall consist of a 2-inch blanket under a sectional preformed sheet metal lagging. This insulation must be readily removable and capable of being reinstalled, if required.

2.3.8.8 Boiler Trim

Boiler controls and trim shall be factory installed and wired to comply with UL and the latest state and county codes.

A low water cutoff control (manual reset) shall be mounted on the top centerline of the boiler wired into the burner control circuit to prevent burner operation if boiler water level falls below a safe level.

Pressure and temperature gauges shall be mounted on the boiler with temperature sensing element located adjacent to the hot water outlet. Water relief valves of a type and size to comply with ASME Code requirements shall be mounted on the unit.

Temperature controls to regulate burner operation shall be mounted on the unit with temperature sensing elements located adjacent to the hot water outlet. Controls shall be high limit (manual reset), operating limit (auto reset), and firing rate control.

Boiler trim shall include:

1. ASME Relief Valve, set at 30 PSI.
2. Combination Temperature and Pressure Gage.
3. Main Gas Shut-off Cock.
4. Pilot Gas Cock, Regulator, and Solenoid Valve.
5. Gas Pressure Regulator.
6. Main Gas Valve, Motorized.
7. Motorized Modulating Valve.
8. Operating Control
9. Modulating Control
10. Manual Reset High Limit
11. Manual Reset Low Water Cutoff
12. Stack Thermometer
13. 10" Diameter Top Flue Outlet
14. Forced draft propane gas/digester gas fired burner.
15. UL/IRI/CSD-I Compliant.
16. Full modulating firing with manual potentiometer.
17. Low & high gas pressure switches.
18. Leak test cocks.
19. Pre-piped and wired propane and digester gas trains.
20. RM 7800L flame safeguard.

2.3.8.9 Exhaust Stack System

Provide boiler with exhaust stack system. Exhaust stack straight and elbow sections shall be double wall, size as required for the boiler outlet adapter, 20 gauge 304 stainless steel, 1,400°F factory built chimney, 1-inch air, length as required for installation as shown. Additional materials to comprise the system shall be as follows:

- flangless boiler outlet adapter
- 6-inch long inline drain section
- adjustable expansion section
- half drawband
- plate support assembly
- roof penetration assembly (including insulated thimble, flashing, roof curb, support plate and rain collar)
- drawband
- 45 degree elbow
- vee band
- rainskirt
- double cone raincap with vee band and 316 SS bird screen
- high temperature silicone sealant

2.3.8.10 Boiler Burner

The burner furnished with the boiler shall be of the forced draft design with combustion air being furnished to the burner by an air blower and shall be integral to the boiler. The burner shall be integral with the front head of the boiler and of the high radiant, dual canister, multi-port type for two different gases. The dual canister burner shall be designed to assure that each fuel is introduced to the

combustion process through a separate orifice ring that is each sized based on the fuel specifications to optimize combustion performance throughout the firing range. Means shall be provided to cool the digester gas portion of the dual canister burner ring whenever propane gas is firing. The forced draft blower shall be mounted in the front boiler door, above the burner, to eliminate vibration and reduce noise level. The blower impeller shall be cast aluminum, radial blade, carefully balanced and directly connected to the blower motor shaft. Induced draft fans will not be allowed.

The burner shall be provided with all the necessary controls required for the automatic burning of either digester gas or propane gas. The burner shall be setup to burn digester gas as long as it is available. Automatic controls shall be provided to burn digester gas until the digester gas pressure is reduced to five inches of WC. The burner shall operate without the need for a gas booster pump. A sensitive digester gas pressure switch shall be included to automatically switch the burner from digester gas to propane gas upon depletion of the available digester gas supply. When the digester gas supply is restored, the burner shall automatically switch back to this fuel. This switchover shall occur when digester gas pressure has been restored to eight inches of W.C. A selector switch shall be provided to permit burner operation on "Propane Gas Only", or "Automatic Switchover". When operating on "Automatic Switchover", the pressure switch shall recycle the burner until all available digester gas is exhausted prior to burning propane gas. The unit shall also be supplied with the necessary pumps and filters for the alternate fuels.

The control system for each burner shall provide a 30 second pre-purge before any starting cycle, after a power failure, and at fuel switchover. A substantial pilot must be established in the burner before admission of gas supply to the burner. The burner shall automatically relight after each fuel interruption if the supply is restored within 30 seconds. Included with each burner shall be a control panel containing all burner controls, blower motor relay, timers and other appurtenances, all of which shall be mounted on the boiler body, and completely wired to the necessary remote controls and valves through a numbered terminal block furnished with the control panel.

Positive control of the fuel supply shall be maintained by employing an infrared flame scanner solid-state flame protection device. The flame protection devices shall be Underwriters' Laboratories and Factory Mutual approved. In the event of flame failure, the fuel supply valve shall positively close and an alarm sounded.

Burner operation shall be based on the full modulation principle and shall be UL/IRI/CSD-1 compliant. The burner shall always return to low fire position for ignition. Digester gas content will limit the burner turndown in order to maintain flame stability at minimum firing rates.

2.3.8.11 Gas Burner Piping

Gas burner carbon steel piping shall include a "block and bleed" arrangement with two pneumatically operated primary gas shutoff valves. One valve shall include a "proof of closure" feature to be interlocked with the burner sequence controller to prevent burner operation if the valve is not fully closed. The gas piping train shall also include a vent valve located between two safety valves to vent any leakage. The size of the Digester Gas train is depend upon the Digester Gas pressure available at the inlet to the pressure regulator. Two manually operated plug valves shall be provided; one upstream and one downstream of the safety shutoff valves. Both the safety pneumatically operated and manually operated valves shall be designed and warranted for Digester Gas Service including cast iron bodies with stainless steel resilient faced eccentric plugs. High and Low Gas pressure switches shall be provided that is designed and warranted for Digester Gas Service and Factory Mutual approved. A mounted, piped and wired air compressor shall be provided for the pneumatic safety valve actuator

requirements. A separate cam operated linkage shall be provided to control the Digester Gas flow rate. All electrical components other than gas valves will have individual UL ratings.

2.3.8.12 Motors

Motors shall be standard horizontal, weather proof electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI and IEEE standards. Motor shall be constructed with Class B or F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplate rating shall be 3/4 HP, 460 volts AC, 3 phase, 60 HZ, continuous duty at 40°C ambient air temperature with a 1.15 service factor.

Motor shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the project.

2.3.8.13 Control Panel

Each boiler shall be supplied with its own control panel mounted on the front door of the boiler in a location convenient to the operator. The bottom height of the panel shall be at least 4 feet above the floor. The control panel shall be a hinged metal cabinet with a NEMA 1A rating that includes a neoprene dust seal and a cabinet key type lock. The panel shall contain the boiler flame safeguard controller, blower motor starters, indicating lights and selector switches. The panel shall have a removable subbase for mounting the flame safe guard controller, blower motor and terminal blocks. Controllers shall be in accordance with NEMA ICS 1, circuit breakers shall be in accordance with NEMA SG 3, and motor controls and motor control centers shall be in accordance with NEMA ICS 1, NEMA ICS 2, NEMA ICS 3, NEMA ICS 4, NEMA ICS 6, UL 508, and UL 845. The control panel shall be NEMA 250, Type 12 construction and shall have a single swing out door. All equipment shall be mounted and wired with rigid steel conduit and flexible water-tight connectors, all in accordance with NFPA 70. The following selector switches and indicating lamps, clearly labeled, shall be provided on the exterior of the control panel doors:

- Digester heater switch (manual/automatic/off).
- Fuel selection switch (digester gas/propane/automatic).
- Constant water bath switch (on/off).
- Induced draft fan (automatic/continuous).
- Low boiler water lamp with alarm horn and silencer.
- Blower fan failure lamp with alarm horn and silencer.
- Flame failure lamp with alarm horn and silencer.
- Boiler high temperature lamp with alarm horn and silencer.

2.3.8.14 Digester Temperature Control

Automatic control of the temperature of the digester contents within plus or minus 1°F shall be accomplished by means of an extra-sensitive thermostatic switch inserted in the sludge piping as shown on

the Plans. The temperature sensor located in the sludge line from the digester to the heat exchanger will transmit the temperature of the sludge to the temperature controller that will modulate the temperature regulating valve to maintain an operator adjustable temperature. As the temperature of the digester increases the valve is modulated allowing less hot water to enter the heat exchanger. As the temperature of the digester decreases, the valve is modulated to allow more hot water to enter the heat exchanger.

2.3.8.15 Electrical

Electrical connections provided between equipment and/or devices mounted on the boiler equipment shall be connected in accordance with Division 16, ELECTRICAL, whether provided by the factory or made in the field. This requirement shall pertain to conduit, fittings conductors, supports, hangers, and similar items.

The Contractor shall supply and install all field wiring required including but not limited to proper size wire, conduit, fittings, and supports.

The power supply for the burner control panel shall be 460 volt, 60 hertz, 3 phase. The burner control panel shall contain a control power circuit transformer to provide a 115 volt, 60 hertz, single phase power supply to the control circuits. Fused disconnect switches shall be provided and mounted in the control panel for incoming three phase power.

2.3.8.16 Thermometers

Indicating thermometers, with a range from 0 degrees F to 150 degrees F, shall be provided in the sludge inlet and outlet pipes of the heat exchanger. Each thermometer shall be provided with a mounting socket that will enable the removal of the thermometers without draining the sludge tubes of the heat exchanger.

2.3.8.17 Accessories

Provide expansion tanks, vent valves, sight glasses and pressure reducing valves, sized by the boiler manufacturer and installed as shown on the Drawings.

2.3.9 Hydroneumatic Pressure Tank

The pressure tank shall be a diaphragm – type hydropneumatic tank with a replaceable diaphragm. The pressure tank shall be a vertical, free standing model with an integral floor stand.

The pressure tank shall be welded steel, constructed, tested, and stamped in accordance with Section V111 of the ASME code for a working pressure of 125 psi and pre-charged to the minimum operating pressure. The pressure tank shall have a minimum operating volume of 132 gallons. The pressure tank shall be AMTROL Model 500-L or equal.

2.3.10 Air Separators

The air separators shall be of the tangential type with a low velocity vortex. They shall be designed for use with the air elimination system without a strainer and without baffling.

The air separators shall be welded steel, constructed and stamped in accordance with Section V111 of the ASME code for a working pressure of 125 psi. The air separators shall be AMTROL Model 3-AS-L or 4-AS-L as shown on the Drawings, or equal.

2.3.11 Air Elimination Valves

The air elimination valves shall be designed to eliminate air to the atmosphere as fast as the air separator separates it from the water. This valve shall be float activated, remote pressure operated and shall be designed for installation on the top of the air separators.

The valve shall have a high removal rate at low pressure differentials and shall be fully open for the removal of air at pressure in the operating range from 2 to 150 psig. It shall be tightly sealed against loss of system water and prevent entrance of air in negative pressure situations.

The air elimination valve shall be metal and all working parts shall be non-corrosive with working pressures of up to 125 psi. The air elimination valves shall be AMTROL Model 720 or equal.

2.3.12 Manual Shot (Chemical) Feeder

The manual shot feeder shall be capable of batch feeding chemicals into a closed loop system. The shot feeder shall be of all welded steel construction and shall have a capacity of 5-gallons. The shot feeder shall include the tank, 1/2" screwed inlet, 1" screwed outlet, 1/2" sample valve, 6" diameter funnel and three support legs.

2.3.13 Sludge Circulating Pump

Pump shall be as specified in Section 11310.

2.3.14 Sludge Piping

As specified in Section 15200.

2.3.15 Boiler Water Circulation Pumps

As specified in Section 11211.

2.4 NAMEPLATES

Each major component shall have a nameplate affixed to the unit in a conspicuous place. All nameplates shall be of stainless steel suitably attached to the equipment. Nameplates shall contain the manufacturer's name, size and type of equipment, serial number, and other pertinent data.

2.5 PAINTING

The factory boiler shall be factory painted with hard finish, heat resistant enamel coating. All other painting, including surface preparation and priming shall be in accordance with Section 09900. Fiberglass, stainless steel, and galvanized components need not be painted. Field painting shall be in accordance with Section 09900.

2.6 EQUIPMENT INSTALLATION

Equipment shall be installed where indicated and in accordance with the manufacturer's written instructions and under the supervision of the manufacturer's representative. Sufficient clearances shall be provided around all equipment to allow for proper operation and maintenance and removal of equipment components. Connections with or protrusions through the digester cover or walls shall be gastight. Special attention shall be given to the proper installation of gas and fuel systems to insure safe operation.

3 EXECUTION

3.1 WELDING

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

3.2 TESTING

3.2.1 Operational Field Test

The entire gas and heating shall be subjected to an operational test to demonstrate satisfactory functional efficiency.

The system shall be operated entirely on water for a minimum of 24 continuous hours before sludge is allowed to enter the system. There shall be no unusual operation during this run-in period. Motor amperage shall be checked at least hourly for any unusual or higher than normal figures. After the unit has successfully passed this initial test, sludge shall be introduced into the system and the same 24 hour observation test run. If the unit shall fail under any of these conditions, the test shall be halted and the problem corrected. If, after several attempts, the unit does not successfully pass the field test, the faulty portion of the equipment shall be replaced and the test re-run.

3.3 MANUFACTURER'S REPRESENTATIVE

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, demonstration and testing of the equipment.

A representative of the Boiler manufacturer shall be provided to inspect the equipment installation, make any field adjustments necessary to ensure proper system operation, startup, and testing. Manufacturer's services shall include four (4) days (four visits) at the site and shall be included in the bid price: one trip for inspecting, testing, and certification; one trip for startup and two (2) trips for training.

3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 16 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the equipment operation and maintenance manuals.

END OF SECTION

SECTION 11601

LABORATORY EQUIPMENT AND FUMEHOODS

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 2080 (1992) Industrial Ventilation

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 366 (1997) Commercial Quality (CS) Steel, Carbon, (0.15 Maximum Percent) Cold-Rolled

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C 1048 (1997; Rev. B) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 45 (1996) Fire Protection for Laboratories Using Chemicals

NFPA 70 (1999) National Electrical Code

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

Provide final utility connections and utility service to equipment including waste, under; 15400, PLUMBING GENERAL PURPOSE.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, SUBMITTAL PROCEDURES.

Shop Drawings

Laboratory equipment and fume hood layout; G

Laboratory equipment and hood schedules

Product Data

Fumehood assembly; G

Include descriptive literature, technical data sheets, and diagrams.

Samples

Exterior hood paint; G

Test Reports

Fumehood test; G

Base cabinet test; G

Manufacturer's Instructions

Fumehood assembly

Operation and Maintenance Data

Operation and Maintenance Instructions; G

See Section 01701 for requirements.

1.4 SUBMITTAL REQUIREMENTS

1.4.1 Hood Paint

Submit color chips of exterior hood paint. Submit at least five colors which are standard with the manufacturer.

1.4.2 Drawing Requirements

Show pertinent installation layout. Indicate details of construction and rough-in requirements.

1.4.3 Tests

Submit fumehood test and cabinet test reports required by ACGIH 2080.

2 PRODUCTS

2.1 MATERIALS, COMPONENTS, AND SPECIAL DESIGN REQUIREMENTS

2.1.1 Aluminum Alloy

ASTM B 221 equivalent in ultimate tensile, yield, and shear strengths to Alloy 6063-T5 or 6063-T6.

2.1.2 Carbon Steel

ASTM A 366, cold rolled sheets, commercial bright finish.

2.1.3 Stainless Steel

ASTM A 167; No 4 satin finish including welds and fabricated surfaces. Provide Type 302, 304, or 316 alloy unless otherwise specified. Provide minimum thickness of U.S. Standard 16 gage, except 14 gage for working surface.

2.1.4 Safety Glass

ASTM C 1048, fully tempered "FT," clear.

2.1.5 Fumehood Design

Design, calculate face velocities, and test fume hoods in accordance with ACGIH 2080, Laboratory fume hoods, auxiliary systems, and associated equipment shall meet the requirements of NFPA 70 and NFPA 45.

2.1.6 Hood Static Pressure Loss

With the sash in full-open position the static pressure loss through the fumehood shall not exceed 1/2 inch water gage when operating at 75 feet per minute (fpm), 7/8 inch water gage at 100 fpm, 1.125 inch water gage at 125 fpm. For hoods equipped with bypass, the static pressure loss and exhaust volume shall remain relatively constant (within 5 percent) regardless of sash position.

2.1.7 Electrical Devices

Prewired at the factory to a common, integral junction box to provide easy exterior connection and disconnection.

2.2 UNITS

2.2.1 Unit (4' Fume Hood, 6' Fume Hood)

2.2.2 Fumehood Assembly, Constant Volume

4' Fume Hood:

Constant volume, configuration, enclosed unit mounted on base cabinet; exterior dimensions maximum 49 inches wide (across face) by 30 inches deep (front to back) by 96 inches high; interior working area at least 36 inches wide 24 inches deep by 47 inches high.

6' Fume Hood:

Constant volume, configuration, enclosed unit mounted on base cabinet; exterior dimensions maximum 72" inches wide (across face) by 30 inches deep (front to back) by 96 inches high; interior working area at least 60 inches wide 24 inches deep by 47 inches high.

2.2.2.1 Base Cabinet Portion of Assembly

Carbon steel, modified to have recessed apron to contain electrical convenience outlets.

2.2.2.2 Hood Interior, Including Working Surface

Type 304 stainless steel, with interior vertical joints and intersections of vertical surface with working surface having an approximate 3/4 inch radius. Provide working surface with a raised rim around all sides to prevent spillage from running out face of hood.

2.2.2.3 Sash

Safety glass, 1/4 inch minimum thickness. A two panel combination sash system designed to move synchronously with a single counter weight. The top sash shall move upwards at half the speed of the lower sash. The top vertical sash is of frameless design, with 1/4 inch laminated safety glass. The bottom framed sash uses eccentrically sized 22 inch high panels of 1/4 inch laminated safety glass. counterbalanced, telescoping combination type, Type 304 stainless steel frame. Provide with defeatable sash stops set at vertical openings of 0 inch and 10.

2.2.2.4 Warning Signage:

At 0" sash stop: "Close Horizontal Sash Panels Before Raising". At 10" sash stop: "Setups Only above this Point". On lower rail of upper sash: "Close-Horizontal Sash Panels." This sign is hidden until lower sash is raised above 0" sash stop.

2.2.2.5 Baffle

Adjustable, with moving parts resistant to corrosion, removable for cleaning.

2.2.2.6 Lighting Fixtures

Fluorescent, with cool white lamps and switch, providing 75 foot candles on working area. Locate switch for fixture on exterior of hood frame, or in recess of base cabinet. Provide sealed safety glass window barrier between interior working and fixture spaces, and access for tube replacement exterior to hood interior working area.

2.2.2.7 Service Fixtures

Provide remote controls for piped services and locate on hood exterior frame. Provide serrated supply ends with nozzles arranged close to sash, precluding the need of reaching to interior back of hood to make connections to outlets. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with chemical resistant coating of clear plastic over polished chrome plate.

- a. Cold water: Remote controlled valve, with vacuum breaker; hood wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall and over cup sink.
- b. Acid waste: Recessed cup sink, 3 by 6 inches or 3 by 9 inches, fabricated of Type 316 stainless steel, 2 liter capacity. Furnish with acid waste p-trap and locate under water faucet, integral with countertop. Provide acid vent.

- c. Electrical convenience outlets: Two duplex, grounded, three-wire, 125 volt, 60 Hz, single phase, 20 ampere. Locate in recessed area of base cabinet or on side posts of hood. Provide stainless steel or chrome-plated cover plate. Provide 15 ampere circuit breaker protection.

2.2.2.8 Fan Switch

Single-pole, 115-volt, 60-Hz, with pilot light. Locate switch in hood frame or in recess of base cabinet.

2.2.2.9 Duct Stub

Collar size suitable for ductwork indicated. Finish of areas that may come in direct contact with fumes shall be same material and finish as hood interior.

2.2.2.10 Light Fixtures

Fluorescent, prewired, with cool white bulbs, with switch hood-mounted exterior to working area.

2.2.2.11 Service Fittings

Locate remote controls for piped services on hood exterior; provide serrated supply end. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with chemical resistant coating of clear plastic over polished chrome plate.

- a. Cold water: Remote controlled valve with vacuum breaker; hood-wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall.
- b. Sink and drain: 12 inches long by 6 inches wide by 2 inches deep; minimum of 0.050 inch thick stainless steel, welded into surface of cabinet, corners coved to not less than 1/4 inch radius. Provide with stainless steel strainer; drain plug; and 1 1/2 inch borosilicate glass non-siphon P-Trap, with compression joints and bottom clean-out fitting.
- c. Electrical convenience outlets: Two polarized duplex, grounded, three-wire, 125 volt, 60-Hz., single phase, 20 ampere. Locate on exterior of hood front or on hood sidewalls near hood front. Include stainless steel or chrome-plated cover plate. Provide 15-ampere circuit breaker.

2.2.2.12 Viewing Panel

Safety glass, 1/4 inch minimum thickness.

2.2.2.13 Warning System

Ensure detection and alarm for insufficient air velocities caused by failure of exhaust system or by dirty filters. The alarm system shall indicate the actual face velocity of the hood regardless of sash position or orientation in feet per minute. The system shall have an air velocity sensor mounted on the interior side liner of the hood connected to a perforated averaging tube running across the entire front interior of the hood. The alarm signals shall activate any time the face velocity falls below the low velocity alarm set point or rises above the high velocity alarm set point. There should be both a visible and audible alarm. The audible alarm shall have a mute. A scroll-type recorded read-out of alarm events for the past 60 minutes will also be displayed.

2.3 Laboratory Dishwasher

Laboratory dishwasher shall be undercounter model. Washer interior shall be constructed completely of corrosion resistant 304-stainless steel. Units shall be equipped with multidirectional spray system featuring upper and lower counter-rotating spray arms for thorough cleaning and rinsing of glassware on both levels. Units shall also be equipped with an automatic ventilation system and triple insulation .

Wash programs shall include up to 21 routines such as light, normal and heavy wash cycles; a rinse/hold cycle; a final rinse cycle and a forced-air dry cycle with selection of heat or no heat. Wash programs shall be capable of concluding with a deionized water final rinse cycle. Water temperature shall be selectable at either 55 or 65 degrees C.

In addition to the standard top and bottom open racks the dishwasher shall be supplied with a stand alone lower spindle rack that can be used in lieu of the lower open rack. The spindles shall be 8-inches tall and shall be designed for 12-inches of clearance. Each rack shall include 22 plastic -tipped spindles to protect glassware as well as clips for holding glassware at the ideal washing height.

The dishwasher shall be UL listed and operate on a 120V, 60Hz, 15A service. The dishwasher shall be National model NLW-126 or equal.

3 EXECUTION

3.1 INSTALLATION

Install units at locations indicated. Utility installation provisions of Section 15400, PLUMBING, GENERAL PURPOSE; Provide interlocks for controls and alarms to maintain the required air balance between hood interiors and the room.

3.2 POSTED OPERATING INSTRUCTIONS

Post operating instructions.

3.3 FIELD QUALITY CONTROL

3.3.1 Inspection

Examine each unit for visual defects, operation and conformance to specifications.

3.3.2 Tests

Test each unit to ensure that the equipment is operational and conforms to specification requirements. Field tests for fume hood operation and performance shall meet the requirements of ACGIH 2080.

END OF SECTION

SECTION 13211

PRESSURE VESSELS FOR STORAGE OF PROPANE GAS

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1999) Ferritic Malleable Iron Castings
ASTM A 312	(1995a) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 376	(1996) Seamless Austenitic Steel Pipe for High-Temperature Central-Station Service
ASTM A 395	(1999) Ferritic Ductile Iron Pressure-Retaining Casting for Use at Elevated Temperatures
ASTM A 403	(1998) Wrought Austenitic Stainless Steel Piping Fittings

ASME INTERNATIONAL (ASME)

ASME B31.3	(1999) Process Piping
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 58	Standard for the Storage and Handling of Liquefied Petroleum Gases
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Installation; G

Dimensional drawings of the fuel storage tanks with main header connected at the top and bottom of the tanks. Drawings should include piping layout including unloading station.

Product Data

Equipment; G

A complete list of equipment, tanks and material, including manufacturer's description data and technical literature, catalog cuts and installation instructions.

Test Reports

Manufacturer's Affidavits

Furnish an affidavit from the propane storage tank supplier stating that the system has been properly installed and tested, and is ready for full-time operation in conformance with these Specifications before filling with fuel.

1.3 SCOPE

The work specified in this section includes the furnishing of all materials, labor and equipment to construct the propane fuel system for the boilers, waste gas burner and laboratory.

1.4 IDENTIFICATION

A nameplate shall be used on vessels except when stamping is directly applied. A nameplate plainly stamped in letters not less than 3/8 inch high shall be permanently attached to vessel or vessel assembly structure at a conspicuous location. Attachment to shell or head portions or around the nozzle openings of vessel shall be by welding, brazing, soldering, or by tamper-resistant mechanical fasteners of suitable metal construction. Attachment by pressure sensitive adhesives of any type is not acceptable. Stamping shall show serial number, symbols of the manufacturer, specification number, date of manufacture, design pressure, test pressure, maximum allowable working pressure at operating temperature, minimum working temperature for vessels that operate, and water volume capacity in cubic feet to nearest tenth. Manifolds shall be identified by a stainless steel plate or tag attached by stainless steel bands or clamps and shall show serial number, if any, symbols of the manufacturer, specification number, date of manufacture, design pressure, and test pressure. Vessels shall be code stamped in accordance with ASME BPV VIII Div 1.

1.4.1 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2 PRODUCTS

2.1 PROPANE STORAGE TANK

The liquid propane storage tanks shall each have 1,000 gallon capacity with dimensions of 3'-5" dia. x 16'-10" in length. The unit shall be made of ASME construction and code stamped rated at 250 psi W.P. @ 200 degrees F and tested at 375 psi.

2.2 ~~(NOT USED) UNLOADING STATION~~

~~The unloading station shall be comprised of liquid and vapor pipeline extending from the hookup ports to the propane storage tanks. The hookup ports shall be anchored using a concrete bulkhead to have a predictable breakaway point to retain intact the valves and piping on the storage tank side of the hookup ports.~~

~~The unloading station shall be Sam Dick Industries, Inc., High Capacity Truck Transport unloading station, or equal.~~

2.3 PIPING FOR MANIFOLDS

Piping for manifolds shall be seamless stainless steel pipe or stainless steel tubing suitable for service and pressure through a temperature range of plus 120 degrees F to minus 125 degrees F, in accordance with ASME B31.3. Stainless steel pipe in thicknesses up to and including Schedule 80S shall conform to ASTM A 312, Grade TP 304L or ASTM A 376, Grade TP 304; thicknesses greater than Schedule 80S shall conform to ASTM A 376, Grade TP 304.

2.4 FITTINGS FOR MANIFOLDS

Fittings for manifolds shall be seamless butt weld or socket-weld type and of material conforming to ASTM A 403, Grade WP 304L, or if tubing is used, fittings shall be stainless steel positive mechanical high-pressure threaded type. Fittings shall be suitable for pressures specified for vessels and shall be compatible with manifold piping or tubing.

2.5 PROPANE TANK SYSTEM APPURTENANCES

Propane tank appurtenances shall be fabricated of materials suitable for LP Gas service and resistant to the action of LP Gas under service conditions. Those portion of the appurtenances which are subjected to pressure under normal operating condition shall have a minimum melting point of 1,500°F such as steel, ductile iron, malleable iron, or brass. Ductile iron shall meet the requirements of ASTM A395 or equivalent and malleable iron the requirements of ASTM A47 or equivalent. Cast iron shall not be used. Propane tank appurtenances shall have a rated minimum working pressure of 250 psig. Gaskets used to retain LP Gas in propane tanks shall be resistant to the action of LP Gas. They shall be made of metal having a melting point over 1,500°F.

2.5.1 Excess Flow Check Valves

Excess flow check valves shall be designed to close automatically at the rated flows of vapor or liquid by the valve manufacturer. Excess flow valves shall be designed with a bypass, not-to-exceed a No. 60 drill size opening, to allow equalization of pressure.

2.5.2 Manual Shutoff Valves

Manual shutoff valves shall be designed to provide positive closure under service conditions. The valves shall be made of ductile iron with 60,000 psig tensile strength and 45,000 psig yield strength with elongation of 15%. The valve shall have the ability to withstand impact, wrenching stresses and thermal shock.

2.5.3 Regulators

Regulators shall be suitable for use with LP Gas. Manifolds and fittings connecting propane tanks to pressure regulator inlets shall be designed for at least 250 psig service pressure. Regulators shall be designed, installed, and protected so their operation will not be affected by the elements. The regulator shall be equipped with one of the following:

1. A pressure relief valves
2. A shutoff device that shuts the gas off at the regulator inlet. (This device shall not open to permit flow of gas until it has been manually reset.)

2.5.4 Relief Valves

Pressure relief valves shall be of sufficient individual for aggregate capacity as to provide the relieving capacity in accordance with Appendix E (NFPA 58) for the container on which they are installed, and to relieve at not less than the rate indicated before the pressure is in excess of 120 percent of the maximum permitted start-to-leak pressure setting of the device. Each pressure valve shall be plainly and permanently marked with the following:

1. Pressure in psig at which the valve is set to start-to-leak.
2. Rate relieving capacity in cu. ft. per minute of air at 60°F and 14.7 psig.
3. Manufacturer's name and catalog number.

2.5.5 Emergency Shutoff Valves

Emergency shutoff valves shall be approved and incorporate all of the following means of closing:

1. Automatic shutoff through thermal (fire) actuation when fusible elements are used they shall have a melting point not exceeding 250°F.
2. Manual shutoff from a remote location.
3. Manual shutoff at the installed location.

2.6 SUPPLY PIPING APPURTENANCES

Pressure containing metal parts of valves including manual positive shutoff valves, excess-flow check valves, emergency shutoff valves used in piping systems shall be of Type 304L stainless steel. All materials used, including valve seat discs, packing, seals, and diaphragms shall be resistant to the action of LP Gas under service conditions. Valves shall be suitable for the appropriate working pressure, as follows:

Valves used at pressure higher than propane tank pressure, such as in the discharge of the fuel pumps, shall be suitable for a working pressure of at least 350 psig.

Valves to be used with liquid LP Gas or with vapor LP Gas at pressures in excess of 125 psig, but not-to-exceed 250 psig, shall be suitable for a minimum working pressure of at least 250 psig.

Valves to be used with vapor LP Gas at pressure not-to-exceed 125 psig shall be suitable for a working pressure of at least 125 psig.

2.7 NAMEPLATES

The propane storage tank shall have a nameplate affixed to the unit in a conspicuous place. The nameplate shall be of stainless steel suitably attached to the tank. Nameplates shall contain the manufacturer's name, tank capacity and type, pressure and other pertinent data.

2.8 PAINTING

2.8.1 Exterior Surfaces

Exterior surfaces of all vessels, including supports but excluding stainless steel surfaces, shall be cleaned and painted in the shop in accordance with Section 09900. Abraded or corroded spots shall be wire brushed and touched up with the same material as the paint coating.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Equipment

All tanks and equipment shall be installed in accordance with fabricator's instructions and recommendations. All vessels shall be bolted in place on concrete foundations. Care shall be exercised during the placement of vessel on foundation so as not to scratch or dent vessel, or crack foundation.

3.1.2 Piping

All interconnecting piping shall be assembled per fabricator's drawings and instructions. All piping shall conform to the requirements of ASME B31.3.

3.1.2.1 Pipe Supports

Interconnecting piping shall be adequately supported and shall not produce large stresses on the pipe or the vessel nozzles. Pipe hangers and supports shall be in accordance with Section 09900. Pipe supports shall allow for movement of the pipe from thermal expansion or contraction. Pipe support spacing and installation shall conform to the requirements of MSS SP-69.

3.2 FIELD TESTING

Upon completion of all related work and prior to acceptance, the Contractor shall subject the pressure vessel and associated piping and instrumentation to a pressure test to demonstrate system performance. The Contracting Officer shall be present during the testing.

3.2.1 Testing Materials

The Contractor shall furnish all equipment, instruments, materials, and personnel required to perform the test.

3.2.2 Procedure

The test medium shall be clean, dry nitrogen. Piping test pressure shall be not less than 1.2 nor more than 1.5 times the design pressure. The test pressure shall be continuously maintained for a minimum of 10 minutes, and the required test procedure shall be in accordance with ASME B31.3. To pass the pressure test, the piping system shall show no evidence of leaking at all joints and connections by soap bubble or equivalent method. If system does not pass the pressure test, the problem will be corrected and the system will be retested. Any retesting will be performed by the Contractor at the Contractor's expense. If piping test pressure is above the pressure vessel test pressure, the pressure vessel will be isolated from the piping test.

3.3 MANUFACTURER'S REPRESENTATIVE

A representative of the propane fuel system manufacturer shall be provided to inspect the installation and verify that the system has been properly installed and tested, and instruct the Owner's personnel on proper operation and maintenance. Manufacturer's services shall include one day at the site and shall be included in the lump sum bid price.

END OF SECTION